



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>

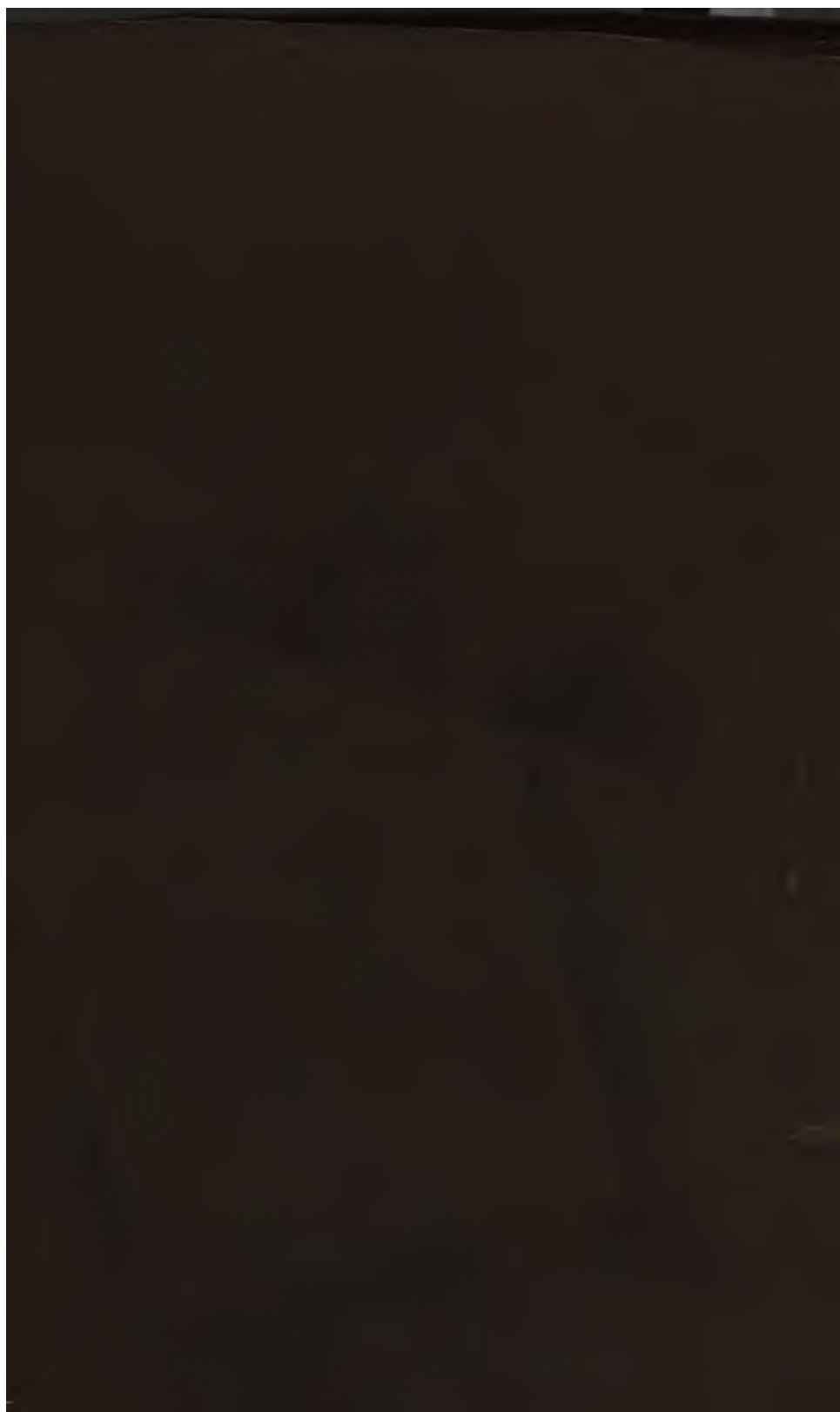
LANE

MEDICAL



LIBRARY

LEVI COOPER LANE FUND



LANE

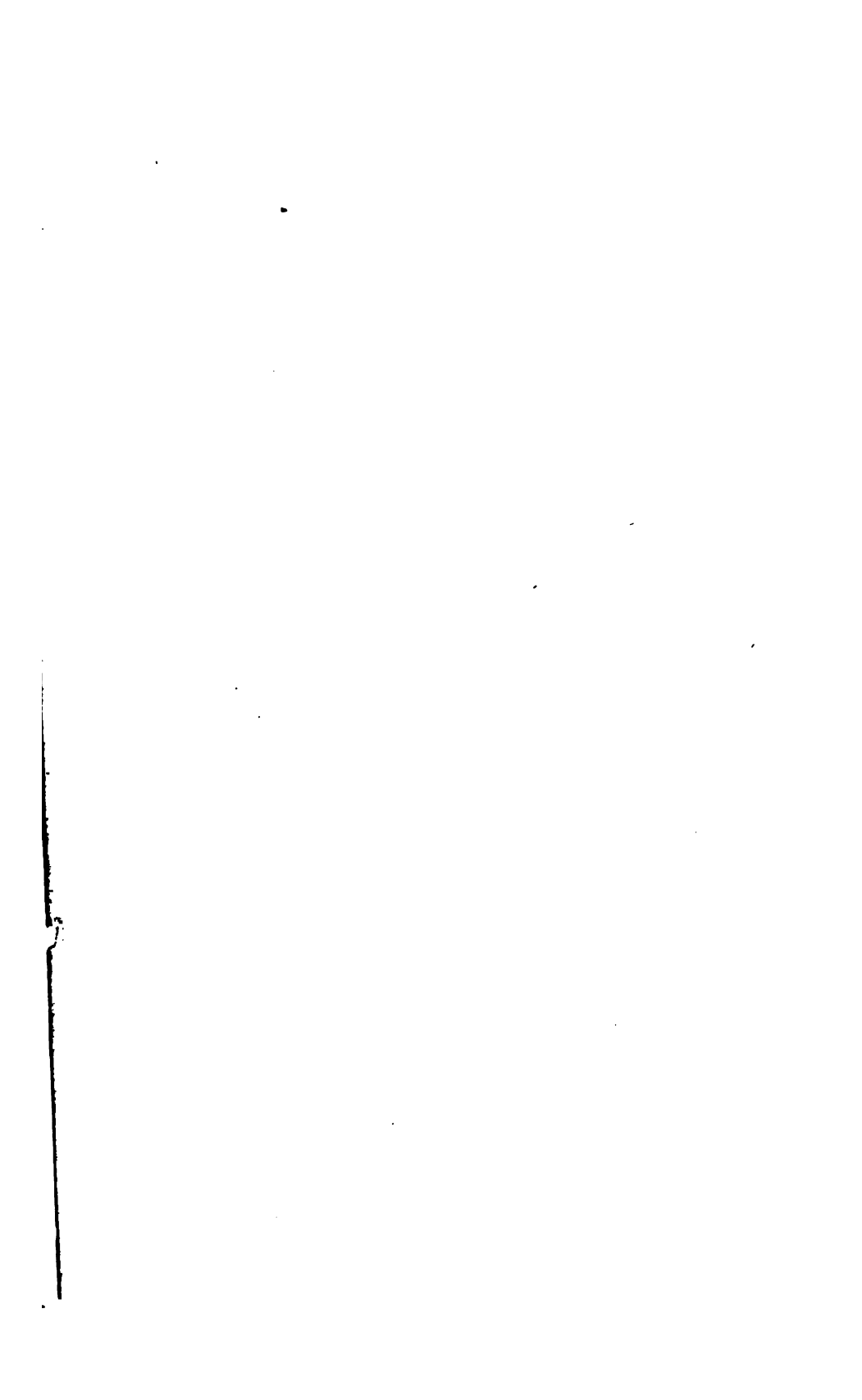


LIBRARY

COOPER LANE FUND

181-

A HANDBOOK
TO THE
SPAS OF EUROPE



ON THE
CURATIVE EFFECTS
OF
BATHS AND WATERS

BEING
A Handbook to the Spas of Europe

BY
DR. JULIUS BRAUN

SPA-PHYSICIAN, REHME-OEYENHAUSEN

INCLUDING A CHAPTER ON THE
TREATMENT OF PHTHISIS

BY BATHS AND CLIMATE

BY DR. RÖHDEN, OF LIPS SPRING

AN ABRIDGED TRANSLATION, WITH NOTES

EDITED BY

HERMANN WEBER, M.D., F.R.C.P.

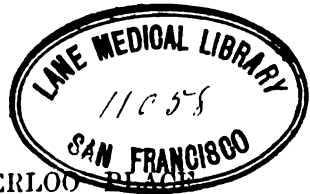
PHYSICIAN TO THE GERMAN HOSPITAL

LONDON
SMITH, ELDER, & CO., 15 WATERLOO PLACE

1875

NY

[All rights reserved]



Y9A9B11 39A1

50 ~ ~
1875

EDITOR'S PREFACE.

THE German and French languages possess excellent works on Balneology. I need only mention the names of Durand-Fardel, Seegen, Dittrich, Helfft, Braun, Lersch, and Valentin, as the authors of handbooks; to which must be added the numerous works on special springs and health-resorts. In the English language, too, the works of Drs. Sutro, Althaus, and Macpherson offer ample opportunities for acquiring knowledge on this subject. In spite of this, however, the familiarity of the majority of English practitioners with the curative effects of baths and waters is not in proportion to their other medical knowledge.

Without discussing the causes of their imperfect acquaintance with so important a branch of medicine, I venture to think that I shall render a service to my English professional brethren by providing them with an edition in their own language of Dr. Braun's Compendium of Balneotherapeutics, a work which is not intended to supersede those mentioned, but rather to serve as an introduction and guide to the practitioner in studying the subject.

Braun's work is especially adapted to convey to the student a correct idea of the curative effects of baths and waters, and the relation of Balneotherapeutics to other kinds of treatment. The complicated nature of the agents at work in courses of treatment by waters away from

home is well described; the influence of the journey, of the change of circumstances, climate, and mode of life, is duly appreciated; the effects to be expected from the increased internal and external use of water alone at different temperatures, and of the substances contained in the water, are reasonably discussed; our uncertainty, and when necessary, our ignorance on these subjects, are frankly exposed; and the limits of what may and may not be expected from certain balneotherapeutic courses, are fairly traced according to the present state of our knowledge.

One of my motives for editing this work, is the hope of inducing teachers at our medical schools regularly to deliver a short course of lectures on the subject of baths and waters, and climate; and I do not know a work better adapted than Dr. Braun's to form the basis of such a course of lectures, especially if the knowledge thus acquired by reading be enlarged by personal visits to the spas.

Above all things, it appears to me necessary to show that the treatment of diseases and morbid tendencies by waters and climate is only a branch of general medicine, that it rests on the same principles, and that it ought to go hand in hand with other measures of sound practice. The very complicated nature of balneotherapeutic plans of treatment is, however, not to be lost sight of; and in every individual case the probable effect of the different influences which come into play, is as far as possible to be appreciated, namely, the leaving home, the journey to the health-resort, the altered social relations at the place, the accommodation, the food, the exercise, the air, and the other climatic elements, and finally, the effect of the baths and of the internal use of the waters.

At present, even in the highest classes of society, the ideas regarding baths and climate are often very curious, and the most marvellous effects are frequently expected with confidence. Thus it is thought sometimes that large tu-

mours, even of carcinomatous nature, may be 'dissolved and absorbed at Creuznach;' that atrophied limbs, in consequence of the so-called essential paralysis of childhood, can be restored at Rehme, or at Gastein, or at Wildbad; that old standing ankylosis of joints or spinal curvatures may be cured by baths; that baldness and other senile changes of various organs, possibly premature, but nevertheless senile, may be remedied by a 'renewal of life' at St. Moritz, or that far advanced phthisis can be cured by a few months at Cannes or Davos.

Although general knowledge is so far advanced that such cures by other means of treatment are regarded as impossible, they are still expected from baths and climate. And this state will probably continue until the general principles of Balneotherapeutics have become part of the regular education of medical men, and are through them communicated to the educated public.

Then it will also be seen that the selection of spas and climatic health-resorts is not quite so simple a matter as is often imagined. It is to be decided in every case whether a balneotherapeutic or climatic course of treatment is preferable to the ordinary medical treatment; and, in selecting a special spa or health-resort, we must take into consideration not only the name of the disease or morbid tendency, but the entire individual, with all its physical and psychical peculiarities. As we do not in ordinary treatment prescribe purgatives for every form of constipation, or astringents and opiates for every case of diarrhoea, so we cannot order chalybeate springs for every case of weakness or anæmia, or hot baths for every form of chronic rheumatism or rheumatic gout. And, further, as it is in ordinary practice often a difficult point, requiring the judgment and tact of the practitioner to an unusual degree, to recognise not only the nature, the extent, and the complications of the disease, and the influences which have produced it, and which keep it

up, but also the whole constitution of the individual, the general strength and the condition and energy of the different organs, and in how far these are able to respond to the demands made on them by the contemplated treatment; so we must, in the selection of spas and climates, constantly keep before our eyes the questions arising from these considerations. We have not only to distinguish what is curable and what is incurable, but, in dealing with the curable, we have carefully to weigh how far the impaired organism can bear the curative measures; whether it is prudent to attempt a radical cure, or to be satisfied with affording some amount of relief with regard to certain features of the illness, perhaps with only a general improvement of powers, postponing further treatment either for another season or for a later period of the same season. Again, in other cases we can expect from the balneo-therapeutic treatment only the commencement of the cure, which afterwards is to be followed up by the usual home treatment.

It will be deemed an advantage, we hope, that the book contains a chapter on water-cures. This subject is not yet sufficiently appreciated by the profession in general, but the rational application of water is likely to become a most important therapeutic aid when once harmonised with our other plans of treatment.

Dr. Rohden's contribution on the Climatic and Balneo-therapeutic Treatment of Consumption will, we trust, likewise be welcomed by many readers, as containing sound hints not only on the climatic, but also the general treatment of consumption.

Finally, it gives me much pleasure to express my sincere thanks to Miss Bunnett, to whom the whole of the meritorious work of translation is due, and to Dr. Alexander Henry for the excellent index and the correction of proofs. My own share in the work has been limited to the condensa-

tion of some parts of the book, and to the addition of occasional notes which are placed in the text, and only distinguished by brackets to mark my responsibility for the same. These notes contain mostly the results of personal experience, and especially information on localities which may be of greater interest to the English than to the German reader, relating principally to England and France. I have also added the names of some of the local physicians, mostly from personal knowledge, or from the authorised local lists; or, in the absence of these, I have taken them from Valentiner's 'Balneotherapie.' I have thought this addition desirable, in order that English medical men might be able to communicate with a local practitioner about their patients, and that these might not use the baths and waters according to the suggestion of some non-professional acquaintance, as many courses of waters are in this way rendered useless, or even hurtful.

It ought, however, to be borne in mind that there are constant changes occurring in the local staffs, and that, therefore, perfect accuracy or completeness cannot be guaranteed.

HERMANN WEBER.

GROSVENOR STREET, W.
July, 1874.

PREFACE

TO

THE THIRD EDITION.

THE rapid and extensive circulation of this book has arisen from the approval which it has met with from practitioners and the majority of spa-physicians. Some of the latter find fault with its subjective character: nevertheless, though this character involves the expression of partial opinions, and possibly even of errors, it is on the subjective character that the effect of the work on the public, for whom it is intended, depends. It must be regarded not as a handbook, but as a compendium; not as a compilation by the author, but as the result of the observation and experience of the physician, who in practical life has maintained the fight against individual and strange delusions. For such an undertaking, the result is, in fact, the decisive criterion. This same subjective character was found fault with in Felix Niemeyer's *Pathology*, and a series of eight editions has refuted this reproach. The teacher of a practical fact teaches just what he knows; he can only represent his own conviction and his own experience. In the course of five years this book has reached the third German edition; in 1869 it was translated into Hungarian; and an English edition is now being prepared by Dr. H. Weber in London.

JUL. BRAUN.

OEYENHAUSEN-REHME:
June 17, 1873.

CONTENTS.

	PAGE
INTRODUCTION AND ARRANGEMENT	1

BOOK I.

GENERAL BALNEOTHERAPY.

INTRODUCTORY REMARKS	9
--------------------------------	---

CHAPTER I.

Removal into other Relations of Life—Travelling—Exercise— Altered Mental Existence—Diet	12
--	----

CHAPTER II.

Country Air as a Remedy—Its Purity, and its different Degrees of Moisture	31
--	----

CHAPTER III.

Warmth, and its Influence on the Health of Man	43
--	----

CHAPTER IV.

The different Density of the Air—Greater or less Elevation of Places above the level of the Sea—Sea-Air—Mountain-Air— Apparatus for the Compression of Air	47
--	----

CHAPTER V.

Increased Use of Water	PAGE 63
----------------------------------	------------

CHAPTER VI.

Preliminary Questions as to the Effect of Baths—Absorption of the Bath-Water—Moisture, Weight, and Temperature of the Water	77
---	----

CHAPTER VII.

Therapeutic Use of Cold—Elementary Effects of the Cold Bath—Forms of Cold Bath and Methods of Treatment—Examination of Indications—Cold Water Establishments	94
--	----

CHAPTER VIII.

Elementary Effect of Warm Baths—Different degrees of Temperature of Warm Baths—Indications for Warm Baths—Indifferent Thermal Baths—Vapour and Sand-Baths—Monsummano—Douches	123
--	-----

BOOK II.

MINERAL BATHS.

INTRODUCTORY REMARKS	193
--------------------------------	-----

CHAPTER I.

Baths containing Common Salt—Sool-Baths—Examination of Indications—Choice of Sool-Baths—Saline Air	194
--	-----

CHAPTER II.

The gaseous Thermal Sool-Baths of Rehms and Nauheim	235
---	-----

CHAPTER III.

	PAGE
Sea-Air and Sea-Baths—Examination of Classes of Cases—Sea-bathing Places of England—Sea-bathing Places near coasts of German Ocean and the Channel—Atlantic and Mediterranean Watering-places—Baltic Sea Watering-places	252

CHAPTER IV.

Sulphur-Baths—Examination of Classes of Cases—Sulphur-Baths in the Pyrenees—German Sulphur-Baths—Euganean Thermæ—Hungarian Sulphur-Thermæ.	266
--	-----

CHAPTER V.

Moor- or Mud-Baths	295
------------------------------	-----

CHAPTER VI.

Alkaline and Chalybeate Springs as Baths—Pine-leaf Baths	301
--	-----

BOOK III.

DRINKING COURSES OF MEDICINAL WATERS.

INTRODUCTORY REMARKS	307
--------------------------------	-----

CHAPTER I.

Carbonic Acid in Mineral Waters—Indications for the Use of Carbonic Acid—Amount of Carbonic Acid in Mineral Waters	310
--	-----

CHAPTER II.

Nitrogen Gas in Mineral Waters	317
--	-----

CHAPTER III.

	PAGE
Carbonate of Soda in Mineral Waters and Alkaline Springs— Physiological importance of Soda—Therapeutic facts and ex- amination of Suitable Cases—Simple Alkaline or Soda-Waters —Muriatic Soda-Waters	320

CHAPTER IV.

Amount of Sulphate of Soda and Sulphate of Magnesia in Water —Soda-Waters containing Sulphate of Soda—Examination of Classes of Cases	356
---	-----

CHAPTER V.

Common Salt-Waters—Physiological effect of Common Salt— Examination of Classes of Cases—Common-Salt Springs ordi- narily used for Courses of Drinking	384
---	-----

CHAPTER VI.

The Internal Use of Sulphur-Waters	413
--	-----

CHAPTER VII.

Earthy Mineral Waters: <i>i.e.</i> those containing Lime	422
--	-----

CHAPTER VIII.

Whey-Cures	433
----------------------	-----

CHAPTER IX.

The Grape-Cure	441
--------------------------	-----

CHAPTER X.

Iron-Waters—Examination of Indications—Chemical Constitu- tion of Iron Springs—List of the best-known Iron-Springs	444
---	-----

CHAPTER XI.

	PAGE
The Minimal component parts of Springs	478

SUPPLEMENT.

Nosological and Clinical Summary of the Contents of the first three Books	481
---	-----

BOOK IV.

**BALNEOTHERAPY AND CLIMATOTHERAPY OF
CHRONIC PULMONARY CONSUMPTION.**

By Dr. L. ROHDEN.

INTRODUCTORY REMARKS	498
--------------------------------	-----

CHAPTER I.

Preliminary Notions—Etiology—Physiology of Phthisis . . .	500
---	-----

CHAPTER II.

Typical Cases of Chronic Pulmonary Consumption—Catarrh (Bronchitis and Peribronchitis)—Pneumonic Process: Conden- sations—Quiescent Conditions with Destruction of Tissue . . .	516
---	-----

CHAPTER III.

Generally applicable Conditions of Cure—Climatology . . .	531
---	-----

CHAPTER IV.

Generally applicable Conditions of Cure (<i>continued</i>)—Abode— Diet—Social Condition	542
--	-----

CHAPTER V.

Spas, and Modes of Treatment in Cases of Phthisis, especially Active Phthisis in Delicate Persons	540
--	-----

CHAPTER VI.

	PAGE
Spas, and Treatment in Stationary Phthisis and Strong Constitutions	560

CHAPTER VII.

Official Climatic Health-resorts—Moist Health-resorts of equable Temperature—Drier Health-resorts—Indifferent Health-resorts	588
--	-----

BOOK V.

<i>THE METHOD OF BALNEOTHERAPEUTIC CURES—REGIMEN—DIET—ARTIFICIAL MINERAL WATERS</i>	613
---	-----

INDEX	637
-----------------	-----

Errata.

- Page 61, line 18, for *Arebir* read *Archiv*.
 " 9 from bottom, for *blackrand* read *blackened*.
 Page 420, column 10 of table, for *Schiuznach* read *Schinznach*.
 " " 12 of table, for *Harkang* read *Harkany*.

N.B.—The passages referred to in the volume from page 88 to 370 inclusive, will be found a page or two beyond the number of the reference.



ON THE

CURATIVE EFFECTS

OF

BATHS AND WATERS.

INTRODUCTION AND ARRANGEMENT.

BALNEOTHERAPY is the science of the method and of the operation of cures by means of baths and springs. It is remote from the plan of a concise compendium to give a history of this art; we will, therefore, confine ourselves to a few remarks on this subject. Historical sketch.

It is well known that the Romans made extensive use of the various forms of baths, not only for hygienic but also for curative purposes. Their knowledge, however, of the constituents of different waters was very imperfect.

During the Middle Ages, Balneology was in almost perfect abeyance.

The commencement of the modern period in its early centuries produced little fruit to medical science, for the revival of the ancient sciences led, above all, to the study of antiquity, and to Aristotle's hard deductive reasoning. Nevertheless, with scholastic learning, the writings and maxims of Hippocrates acquired authority, and with them the first beginnings of true natural philosophy. Bacon of Verulam established scientifically the inductive method, and Harvey's discovery of the circulation of the blood laid the first foundation of physiology. Of all the Modern period.

practical branches, surgery made the most steady progress, whilst internal medicine alternated between metals often alchemically applied, and either innocent or drastic vegetable remedies; and accordingly we find first among some of the great surgeons, such as Ambrose Paré and Gabriel Fallopio, the rational application of cold water to wounds and cases of inflammation.

Although from the fifteenth century the use of mineral baths, especially of natural *thermæ* (warm waters), was gradually more and more adopted, yet a real knowledge of Balneology could not be established so long as the elementary processes of the operation of water, the primary effects of simple cold and warm water, were not investigated. This elementary study was opposed to the general mystical tendency of the age, which delighted in imagining everywhere specific processes, and in discovering or supposing specific agents for them. The natural warmth of the thermal springs was ascribed to a special mystical power, and from the substances held in solution and the effect of the springs, the prevalent humoral pathology attempted superficial and frequently crude explanations, which, moreover, could be only imperfectly aided by the poorest chemical analysis. The analysis of mineral waters is only the product of the nineteenth century. Almost everything that former times had achieved on this subject is thoroughly fruitless as regards the knowledge of waters and their effect; until the time of Paracelsus and Thurneisser the mysterious effects of waters were ascribed to the gold, silver, copper, quicksilver, and even loadstone, which were thought dissolved in them; the rudest attempts at analysis bear the date of the end of the sixteenth century; in 1656 Glauber salts was discovered, *sal mirabile* (!) *Glauberi*, and in 1680 carbonate of soda, hitherto called *nitrum*, after the example of the ancients; from 1750, carbonic acid became known to a certain extent, and about the same time chloride of calcium, chloride of magnesium, and the alkaline character of Karlebad and Ems were defined. But an analysis in the present sense of the word, *i.e.*, a true qualitative and quantitative determination of the ingredients dissolved in various waters,

and especially of their characteristic constituents and of the gases contained in them, did not exist before the third decade of our century, and was first established by the labours of Berzelius and Struve.

There was thus no scientific basis for the employment and explanation of baths; and if notwithstanding, in Germany especially, a balneotherapeutic practice existed, it could only be founded on an empiricism which connected its experience less with the unknown or erroneously explained physical and chemical properties of the waters than with the names of different fashionable springs; and thus we find, in this tolerably sound empiricism of the Hippocratic physicians of the seventeenth and eighteenth centuries, indications resulting from experience, for Wiesbaden, Ems, Karlsbad, Teplitz, Pyrmont, and Aix-la-Chapelle, but not for salt baths, alkaline, neutral, or sulphur-baths, and chalybeate waters. As in the number of springs then used, small as it is compared with that of our own time, the representatives of almost all characteristic groups are to be found, the means of healing possessed by our forefathers, though not so numerous as our own, were nevertheless almost equally complete. The chalybeate springs alone, being more simple in their composition, and their effect being produced by a single ingredient, were universally open to theory, and were therefore most widely used in practice; this was increased by the commonly current notion of 'strengthening,' the need of which naturally forces itself upon the sick, and which must be the final result of all cure and recovery; and thus in the last century, for example, in North Germany, a journey to the baths was almost synonymous with a journey to Pyrmont—an over-estimation of chalybeate springs, which has prevailed even in our own century, and which has been strikingly styled by Hauck an error of the age.

Practice of
the past
century.

Long before analysis was attempted there was an effort made to remedy the first fundamental want, namely, the investigation of the physiological effect of the elementary processes; but it is remarkable that, after the first notable experiments and investigations upon the effect of cold

Use of
cold water.

water, a whole century elapsed before science made use of this practice as a necessary and universally important means. The doctrine of the effect of waters at different temperatures first originated in England; Floyer (1697) is its founder; and already in 1730 the experiments and investigations made by many English physicians in the course of one generation were compiled into a comprehensive monograph by Smith,¹ and at the same time the remedy and the method of applying it found some adherents in Germany, such as Fr. Hoffmann, while in France and Italy several prophets arose who injured the cause by exaggeration. Then two Breslau physicians, J. G. and J. S. Hahn, made some extraordinarily favourable experiments on the effect of cold frictions in many cases of a malignant typhus epidemic in the year 1736, and they described the method and its results in the following year, without meeting with any other reception in Germany than sceptical astonishment. Similar success attended W. Wright in 1777, during a ship's epidemic at sea; and his communications were so little lost upon the practical English, that in the year 1797 Currie's work appeared, which would have been regarded as the foundation of Hydrotherapy, had it met with the success it deserved. Küchenmeister has recently, in his highly meritorious work upon the use of cold water in febrile diseases (Berlin, 1869), pointed out that Currie's method contains all the elements which regulate the thermometrical treatment of fever in use at the present day. So much, however, was the age opposed to all that was simple, elementary, and not Latin, that the great mass of physicians, schooled in Latin prescriptions, declined the use of water, especially of cold water, as a rude and unscientific fancy; and even in the present century such a noted practitioner as Horn had to endure violent and even personal attacks on account of his treatment of typhus with cold water, though for some years in England the treatment of scarlet fever with cold applications had been introduced, with the same success which in our own day has made this remedy the undisputed means to be employed in cases of consuming pyrexia.

¹ *The Curiosities of Common Water*, 6th ed. London, 1724.

If it be asked why a treatment now so universal required so long a time to make its way, there seem to be two different causes : in the first place, the want of a just or sufficient idea of the production of animal heat, and of the effect of abstraction of heat ; and secondly, the want of a strong incitement, shattering old prejudices, which, from the indolence of habit, could only come from without. Just as the errors of Homœopathy freed medical science from the dead weight of the misuse of drugs, by proving that not every acute disease requires a specific mode of treatment ; so the revolution of the peasant, Priessnitz, was needed in order at length to bring to honour a century's experiences of the effect of cold water in acute diseases, and to assert its value also in chronic illness ; and not till then was the incitement given to admit also the elementary effect of warm water within the sphere of scientific and practical observations.

We may date the rise of Priessnitz's system in the year 1830 ; and the same period is marked, not only by the greater extension of homœopathy, but by the conclusion of the analytical labours of Berzelius and Struve upon mineral springs ; three movements sufficient to establish a critical epoch, and at length to turn attention to the elementary processes in the action of baths and waters, and thus to lead to a scientific Balneotherapy. Whatever has been achieved in this branch of the science during the last forty years, little as it may be, and uncertain as it still is, it is yet far more than all preceding centuries have produced ; and the numerous doubts still existing are not based as before on unconscious ignorance, but they have in themselves a scientific importance, because, acknowledged as doubt and uncertainty, they open precise questions which lay the foundation of further investigations. Such is the position of Balneotherapy at the present day.

The achievements of the Balneotherapy of our own period, *i.e.*, from about 1853, are not in proportion to the enormous mass of writings on the subject. Liebig's views on tissue-change, on its retardation and acceleration by various means, have exercised a new and progressive influence : Bischof's researches on urea as a measure of tissue-change

Priessnitz.

Berzelius.

(1853) have given rise to numerous physiological experiments on the action of mineral waters, but these experiments are much more difficult than is generally assumed, and their results are not always available for practical purposes. Clinical observation and experience form, therefore, still to-day, as a hundred years ago, the basis of practical Balneotherapy.

Balneotherapy is the science of the effect of baths and mineral waters on a great, we may say the greatest, number of chronic maladies. As it has consequently to collect its materials wherever they may lie scattered, in physics, meteorology, and chemistry, in pharmacology and pharmacodynamics, and lastly in pathology and therapeutics, it cannot properly be called a complete science; and it is all the less so as, on the one side, the remedies employed in Balneotherapy are very diverse in their effects upon the organism, as, for instance, Glauber's salts and iron, cold-water cure, and change of climate; and as on the other, there is scarcely a simple chronic disease which does not furnish individual cases for the treatment by means of baths and springs.

Practical
importance.

Yet it is just this last fact that gives it its *practical* importance, and entitles it to occupy a place as a special system among the *means of instruction for the physician*. If there is scarcely a single chronic disease which is not in individual cases a subject for Balneotherapy, so also, on the contrary, there is not one, cases of which are not often cured or treated by other means; and the task, therefore, of Balneotherapy is specially to indicate in the *individual* case, whether instead of other methods baths or waters are to be used, which are to be employed, and in what manner.

The practical application of baths and mineral waters dates, however, in no wise from the scientifically established pharmacodynamics of our own day; but it has been transmitted to us from the purely empirical practice of former centuries; and when rational science began to study the dynamics of mineral salts, of sulphur, iron, and warm baths, it started for the most part from the old experience of this empirically practised Balneo-

therapy. Modern pharmaco-dynamics were especially obliged, for example, to ascertain the effect of warm water elementarily and experimentally, because in chronic diseases it had been furnished long before from the experience of Teplitz and other springs, though often interpreted in an erroneous and mystical manner.

For centuries, also, anæmia has been treated with iron, and liver-complaint has been cured at Karlsbad ; and thus Balneotherapy, while other maxims formerly implicitly regarded are wholly repudiated, falls back upon old experience and usage in the use of mineral waters. Balneotherapy, therefore, more than all other therapeutic systems, stands under the influence of the present *transition period*, which strives to reconcile purely experimental and rational art, though it cannot always prevent them from coming into rude and hostile collision. Hence new works on Balneotherapy are now ever appearing, because the necessity of a mediation link between empiricism and science is daily obtruding itself in various forms. To furnish this link, so far as is possible at the present moment, is the task of a compendium, which is to be a school-book in the true sense of the word, and which has three requisites to fulfil. 1. It must state the general therapeutics fully, comprehensively, and with critical regard to established doubts. 2. It must draw the indications first, and above all, from well-established practical experience, and it must endeavour to explain, and if necessary to rectify, this experience by the results of the science and investigation of the present day. 3. As the compendium is to render the student acquainted with a branch of science which, generally speaking, is made obscure by the variance between experience and explanation, and especially so by a confusing multitude of facts and opinions, it ought to compress the superabundance of material into a few general points, and gather together the innumerable quantity of remedies into a few groups and representatives, and thus, by generalising the subject, place the student in a position to individualise ; for a general knowledge alone raises empiricism from the obscure groping of a craft into the light of individual art.

Requisites
for a com-
pendium.

The compendium divides its matter after the following manner.

Division.

As almost all chronic maladies are brought under the influence of Balneotherapeutics in individual cases, and as all cures here effected present certain common therapeutic characteristics, the *first book* will treat of the influence and use of baths and waters in *chronic diseases generally*, and especially of the *elementary effects* of the common agents, air, climate, mode of life, diet, and water internally and externally used. To this division also the *cold-water cure* naturally belongs; and among the specifically diverse balneotherapeutic remedies, the indifferent or simple thermal springs (pepid baths), will here find mention.

The *second book* will follow up the general characteristics by treating of the special chemical qualities of the mineral baths.

The *third book* will treat of the methods of cure effected by the drinking of mineral springs; and, in a supplement annexed, it will give a pathological clinical résumé of the contents of the first three books.

The *fourth book* will contain a dissertation on a branch of medical treatment, which in many respects partakes of the general intention and of certain points of Balneotherapy, and the principles and maxims of which have borrowed much from the latter, namely, the climatic and balneotherapeutic treatment of pulmonary phthisis.

The *fifth book* is a supplement to the whole, somewhat unessential for those readers who have fully acquainted themselves with the contents of the first four books, and useless for those who have not done so. It is upon the mode of life, the diet, and method of balneotherapeutic courses of treatment. It is inserted only because many readers desire such a chapter for their better acquaintance with the subject; and it will, it is to be hoped, fulfil the intention of leading such readers beyond the useless disconnected study of the subject, and of drawing their attention to the connected whole; for the method is in no external to the means, but the means itself is the end.

BOOK I.

GENERAL BALNEOTHERAPY.

The common characteristics of balneotherapeutic cures—Change of habits of life—Country air—Warmth, humidity, density of the atmosphere—Elementary effects of water in different forms and temperatures—Cold-water cure—Indifferent thermal spas—Vapour baths and douche baths.

IF we number together all the balneological clinical experiences of old and modern times, we obtain as an universal result the fact *that diseases of very different kind are cured and alleviated by the same spa, and cases of the same nature are cured and alleviated by very different spas*; and this fact is at once the practical point of view from which the Balneotherapy of the present day must start. This experience dates from the earliest times, when both physicians and people, in their belief in miracles, had recourse, as a last hope, to some well-known springs, without distinction of case and chemical differences; and although from such ignorant practice numerous mistakes must have resulted, still this habit could not have been maintained nor have gained ground, if many successful cases had not invited men to repeat this treatment and to value it. Theory contented itself at that time with assuming a specific unknown virtue in the springs, the mystery of which, just because it was a mystery, they scarcely ventured to explain. When later, *i.e.* after the middle of the seventeenth century, slowly advancing chemistry by degrees disclosed several of the substances dissolved in the waters, the explanation was based on these: still no physiological elucidations were sought for, and science remained satisfied with the discovery of specific salutary influences, and established a countless number of so-called specific rela-

tions of certain substances and certain waters characterized by them, to certain diseases and organs, in the accumulation and confusion of which it was indeed left to the good fortune of the inquirer to discover the remedy for the particular case. Hufeland as a practitioner, and Osann as a balneological writer, especially represent this period. With Vetter's work in 1845, that critical tendency began in Germany which endeavoured to sift the mass of contradictory maxims, and to condense all that belonged together; and since that time scarcely a single work has appeared on general Balneotherapy which has not followed this scientific tendency; but the result, as regards the information of the inquirer, has remained the same, namely, contradiction in the concurring indications for different springs, and the widely dissimilar indications for a single spring.

Common
influences.

In this contradiction of the indications, since these for the most part are the fruit of old-established clinical experience, no reproach can be advanced against Balneotherapy; and it even ceases to be a defect, so soon as it is everywhere practically acknowledged and scientifically explained. If the same mineral springs act similarly upon very different cases, and different springs act similarly upon cases of a like kind, there must be, both in the chemically different remedies and in the different cases of illness, common causes which produce a common result; and the knowledge of these common causes must be obtained before the special qualities of the different waters can be appreciated in their special effect. These influences which concur in all cures effected by means of baths and springs are, travelling, country and mountain life, air, bodily exercise, altered diet, temporary relinquishment of all injurious habits of life, increased consumption of water, and lastly, its external application as the vehicle of moisture, warmth, and cold. As in a compendium on the subject, the critical appreciation of these primary elements must precede all else, in order to explain the effects of the more special differences, and to sift them thoroughly, so Balneotherapy itself only takes its place as a science, when by the study of the elementary effects of water it has opened the way for distinguishing the

special from the general. And it was, as we saw above (page 5), a fortunate concurrence that, at the same time that Priessnitz enforced the study of the effect of water on the part of rational physicians, chemical analysis was also effected by Berzelius and Struve, and thus the discovery of the common operation was aided by the more accurate knowledge of the chemical differences. We do not mean to say by this that in former times the importance of diet, travelling, country life, &c., were unknown; but their adoption into the system of therapeutic principles, their scientific value in accurate indications, and their general use in explaining the effect of cures made by means of baths and springs, are to be traced to the study of the influence of water.

If in many cases it is difficult, and often impossible, to determine the share which the influence of these general and common agencies has had on the success of a course of bathing and drinking of waters, and to distinguish it from the share of the specific powers of the remedy and method, clinical and even popular experience, on the other hand, exhibits thousands of cases in which those general influences, such as travelling, country and mountain air, change of diet, and removal into other circumstances of life, were sufficient for the curative success which in other cases accompanies the prescribed use of baths and springs, and of specific remedies. Hence the general agencies claim more appreciation than that hitherto usually awarded them, almost as a mere matter of course; physics and physiology afford already now sufficient material, at least to prepare the way for a theoretic examination of clinical facts, and to raise them above the designation of the 'incidental,' and they also lose the character of 'self intelligible' matters more and more, as new investigations produce new difficulties and create new questions upon points which for a time ever ready hypothesis had fancied to be beyond discussion.

CHAPTER I.

REMOVAL INTO OTHER RELATIONS OF LIFE—TRAVELLING—
EXERCISE—ALTERED MENTAL EXISTENCE—DIET.

Due
balance
of the
organisa-
tion with
the indi-
vidual
conditions
of life.

THE object of balneotherapeutic treatment consists, with the exception of most cases of psychosis, of the whole range of chronic ailments, whether belonging to the more distinct list of diseases or to the great mass of cases in which health only slightly deviates from its normal condition. The chronic state of health of the individual, the greater or less deviation of his constitution from a healthful condition, is ever the result of the two agents of which organic life is composed, namely, on the one side the *influences* which surrounding circumstances, in the widest sense of the word, constantly exercise on the organisation; and on the other the more or less productive *power of compensation*, by which the latter counterbalances the effect of those influences. Irritation and reaction are the constant phases of this alternation; the reaction manifests itself in the digesting and tissue-forming functions, both indications of life, which are not always to be observed at the moment, and to be measured in their relation to the irritation, but are often unmistakably to be recognised in their final result. There are two points in which this organic compensation is especially plainly expressed, namely, the constant *regulation of warmth* and the ultimate *accustoming* of the organisation to all the influences habitually at work. All organic functions have as their final result the formation of an endlessly and constantly varying sum-total of caloric units; all the properties of the surrounding media, namely, the place of abode, the clothing, the atmosphere, especially the modifications of the latter with regard to its moisture, movement, density, and temperature, exercise a constantly changing influence

Regula-
tion of
caloric.

on the loss of heat; and nevertheless, if no extreme influences are in operation for any length of time, the temperature of the blood and of the cavities of the body maintains itself at a standard, which, under ordinary circumstances, differs only some tenths of a degree both in the single individual and in different men and races, *i.e.*, the heat produced by irritation and reaction accurately corresponds with that lost each moment under the individual circumstances. The irritations, constantly demanding the compensation of the organism, are not always external in the mechanical sense of the word, but often consist in internal morbid conditions of the organs. Disease acts always as a disturbing influence, calling for the compensating powers of the organism, and modifying the reaction on the properly external necessary or accustomed influences.

In the treatment of chronic diseases we require not only the lessons of general *pathology*, but also, and even much more, those of general and practical *physiology*, and the position of the physician is essentially different in acute and in chronic diseases. In the former we have to do predominantly with the distinctly characterized species of illness, powerfully overruling all accompanying conditions; the individuality of the sick person more or less recedes before it, especially when the disease has the character of an infection, and belongs to those specific processes often designated as *cosmical*. The critical examination and treatment of such cases consists, therefore, far more in the practical application to the case of the best established experiences and theories of the species of illness, than in the special consideration of the sick individual; and industry and attention are sufficient to make a man even without genius a successful physician in acute diseases.

It is otherwise with chronic maladies. Even when these manifest specific indications arising from the nosological species, the special condition and the possible power of compensation of the *individual* are additional and essential points, and we are very often thrown upon the latter alone; either because the indistinct diagnosis does not furnish specific indications, or because these have

been acted upon in vain or with imperfect success. Chronic maladies, therefore, make another demand upon the physician: he must individualise, *i.e.*, from his general knowledge of the circumstances of the human *genus*, he must estimate and survey the special circumstances of the *individual*. This demand, therefore, comprises two requirements—namely, a general pathological and physiological mode of viewing things, and a certain power of penetrating the individual, his needs, and his capabilities. In chronic cases, accordingly, the physician is often obliged to leave the studied form of the pathological system, and to take the position of the *practical physiologist*. If we add to this, that the means and methods presented by this position, especially those of Balneotherapy, belong less to special than to general pathology and physiology, it is explicable how it is that general ideas here press into the foreground, and that it is predominantly physiological maxims which sway Balneotherapy as an art, and which govern the estimation and treatment of the individual case. On this, perhaps, depends, in a great measure, the predilection of physicians for balneotherapeutic treatment, and most assuredly the still existing predominance of *humoral* views.

In fact, in spite of the results of modern cellular pathology and physiology the old humoral notions are still adhered to, in the treatment of chronic diseases; the chemistry of fluids and the interchange of gases still affect the many opinions; and even as regards a disease such as pulmonary consumption, which is withdrawn from the hypothesis of dyscrasy by an abundance of concurring anatomical results, and has been elucidated by the researches on the decay of tissues and cells, medical treatment is still under the influence of humoral maxims. In both practice and theory in all chronic diseases, the *fluids and gases* are always spoken of, and rarely *cells and tissues*, and still more rarely the *moving cell*, the *blood-corpuscle*; this most important vehicle, not only of cellular life, but also of the chemical constitution of the blood, especially of its gases. Even the current theories of animal heat are restricted for the most part to the con-

sideration of its chemical sources, whilst the doctrine of mechanical heat-production, the triumph of the present day, points most decidedly to the motion of myriads of blood-corpuscles, as to a fruitful source of heat.

An individual who generally passes through the alternating course of external influences without any considerable and permanent disturbance of his vital functions, is relatively healthy, *i.e.*, he is equally balanced with the conditions of his life; he not only endures the latter, but a certain amount and a certain alternation of them are necessary as habitual provocatives, to keep up the round of accustomed irritation and action. The individual amount of physical and intellectual work, and of alternation between it and repose, the individually habituated amount of nourishment, both as regards quality and quantity, the change of the seasons and the times of the day, and the fluctuating meteorological influences of the atmosphere; all these, in spite of the infinite variety within short periods of time, yet in any complete period, such as a year, form an average aggregate, corresponding with that of any other similar period; and in the same manner the momentary and apparently casual reactions form an amount which is equally great in equal periods of time, and which, as average and accustomed doings, produce the result of organic habit and general balance. This habit and balance raise these external relations of life into *conditions of life*, and the organism, modified and disciplined by their means, requires them not merely of the average kind and extent, but, for a certain amount of good health, it demands a certain amount of permanence and a certain amount of change. The more robust an individual has become, and the less strictly he depends on the kind, extent, amount, and regular change of the conditions of life, the more does he approach the state of *absolute health*, which, however, as no man is permitted complete emancipation from his conditions of life, can only be considered as an abstraction and not as a reality. This almost absolute health, or rather, this relatively high degree of health, presupposes two indispensable things; in the first place, a high degree of physical or mental

Relative health.

activity, or of both combined; and in the second place, a rich supply of food, in the widest sense of the word. Hence we find it especially among those working classes who, in comparatively easy circumstances, have good and abundant food, in keeping with the great consumption of organic matter; and also among many individuals of the upper classes who, like some English statesmen, by very generous and even, according to ordinary notions, immoderate support, endure all the physical and mental fatigues of energetic, restless, and often even dissolute life, to extreme old age, in spite of regular attacks of gout and vesical catarrh, just because enormous sustenance co-operates with enormous physical and mental gymnastics.

Imperfect
balance;
chronic
morbid
conditions.

If the corresponding activity of the individual organism refuses its service, physical derangement is necessarily the result; and this, according to the greater or lesser importance, and the more rapid or slow course of the abnormal phenomena, appears either as acute or as chronic illness, or very frequently in such changes of the constitution as prove not so much exact forms of disease as sickly conditions—conditions of abnormal nutrition which in themselves tend to impede the just balance that has hitherto existed. Whether this refusal of healthy compensation proceeds from gradually developed changes of constitution for the most part very difficult to trace in their early beginnings, or whether it proceeds from some sudden occurrence, some agitating external cause, or some organ casually affected, the consequences in many cases are the same, and comprise an immense field of nosology, a field which exhausts almost the whole series of chronic diseases. Anæmia and general atrophy; atony of the skin, with its manifold consequences, such as catarrh and rheumatism of the joints and muscles; phthisical and scrofulous tendencies from their slight beginnings to the development of phthisis and scrofula; abdominal plethora and the different derangements of the organs of assimilation, corpulence, gout, and rhachitis, hysteria, hypochondriasis, spinal irritation, and that Proteus of symptoms which we designate by the vague but indispensable term, nervous

debility; chronic metritis, which in many cases is the plainest indication of a deficiency of compensation, that is to say, of disturbed involution after childbirth; lastly, general weakness, and, above all, impeded convalescence after acute and chronic illness, and especially after unfavourable and hurtful occurrences in life;—these are to some extent the results proceeding from a want of due balance in the ordinary conditions of life, the scientific and practical importance of which extends almost over the whole field of chronic diseases, and with the indications of which nearly the whole range of Balneotherapy is engaged. Proceeding from the individual relations of life, and maintained and aggravated by them, they imperatively challenged, in those periods when the dogmatic belief in the specific effect of the most ordinary drugs was beginning to be shaken, or when this belief was not even known, the physician's discernment and skill in tracing them back to their general causes, and, in obedience to causal indication, in changing the conditions of life which had produced and fostered them. Such periods have frequently occurred, though they have been always again interrupted by dogmatic periods of specific treatment. The cause of this lay partly in the general progress of the science, and partly in the difficulty of perceiving the close causal relation of certain conditions of life to certain states of sickness; and at a time when medical science consisted principally in writing Latin prescriptions, it required some courage on the part of the great disciples of Hippocrates, Boerhave, Sydenham, and others, to introduce into their remedies the reformation of general conditions of life, and to treat illnesses with baths, diet, gymnastics, travelling, and the like. What those old physicians knew of the nearer effect of these general measures was very little; still less, almost, and not always correct, were their ideas on the matter. But their very merit lies in their discretion, for they resigned themselves entirely to experience and to the logical principle that that which has been observed to agree in the greater number of cases is the *rule*, and that the rule must be followed instead of the law, until the latter should be established by the *How* and the *Why*

Change
of the
conditions
of life.

Boerhave
and
Sydenham.

of cause and effect. Even in recent times, up to the first decades of the present century, no great advance was made beyond this purely logical view ; the scientific treatment of those universal relations only began with the development of the physiology of respiration, digestion, and nutrition, with the explanation of the change of matter and of animal heat, with the investigation of the elementary effect of cold and warm water, and with the more accurate observation of meteorological conditions and their influence on the organised frame. Although clinical experience still remains the guide in this field of medical labour, yet natural science has already furnished material enough to raise mere empirical treatment from the poor position of a craft into the good society of scientific ideas, and to open the prospect of a speedy discovery of practical rules and even of scientific laws.

The means used for our object are: travel, entailing altered mental and physical activity; altered diet, the enjoyment of open air, the influence of summer warmth and of moisture, the effect of a higher or lower situation of the place of abode, the increased or methodical internal use of water, and, lastly, the elementary effect of water at various temperatures and in various kinds of baths.

TRAVEL.

TRAVEL, or to express it more accurately, the condition of the sick person as a *traveller*, is necessarily combined with that course of baths and waters which is gone through at a distance from home, is in many cases the indispensable basis of the cure, and is very often in itself sufficient for success. Travel has been regarded from the earliest times as an important remedy ; and just as the old Boerhave ordered a learned hypochondriac, residing at some distance, to repair to him in person, and to do so, moreover, on foot, so the author himself has seen at his spa many a hypochondriac and many an invalid suffering from nervous debility, to whom he would far rather have prescribed the radical and more agreeable remedy of travel than a course of baths. In other cases, besides

hypochondriasis and sluggishness of the portal system, as, for instance, in several cases of chlorosis, of general weakness arising from too sedentary or busy life, of impeded convalescence, not only after illness but after heavy misfortunes, and especially in cases of spinal irritation which have been designated by the vague term of 'nervous rheumatism,' a journey or a country or mountain residence has proved successful, after baths and waters have been found unavailing.

The thorough mental diversion experienced in a new and unusual condition, and the total *alteration of brain-action* thus caused, is in all cases an important, and in many cases the most important, element in the influence of travel; and even when the state of the sick limits the enjoyment of the journey and the new place of abode, still the mind is refreshed, and the reaction is felt on the physical condition. In the first place, the withdrawal from the habitual routine, and the exchange of restless and complicated circumstances for simple and restful ones, produce a *calmness of mind* which was long lost at home, amid the simultaneous pressure of sickness, of family life saddened by its influence, of domestic and conventional restrictions, and of the claims of business. The sick man takes with him on his journey only the *fruit* of the circumstances of his life; he leaves the conditions of them at home. The fact alone that he leaves the restrictions of an artificial culture, the complications of personal relations, and the sphere of his suffering, and returns to the simple soil of *nature*, gives him back that freedom of mind which is often the regenerator of health, and almost always the necessary condition of recovery. The influence of the mind upon the body is an indubitable fact, both of common popular experience and medical observation, and a remedy of medical practice. The pallor of the countenance and the emaciation of the body in consequence of continued depressing mental emotion, the hair turning grey after violent sorrow, attacks of apoplexy after immoderate anger, and many similar facts, are universally known; medical science, however, reckons mental influences as frequent causes of cancerous dis-

Change of
brain-
action.

eases, and of acquired, *i.e.*, not inherited, disposition to pulmonary phthisis ; and to the most important preventive means against the latter malady belong travel and country residence, and the free enjoyment of Nature.

Diversion
of the
mind from
itself.

The effect produced on the mind of the sick by travel and residence at a watering-place is not vague and mysterious, but recognisable and tangible. The variety of objects, the light and harmonious colouring, delight the eye and enliven the mind ; the purer air which he breathes refreshes him also psychically ; the exercise of the body leads him away from mental speculations, and calms and strengthens the tone of the mind ; sleep gives him daily new powers for these simple and pure enjoyments. Like himself, the companions whom he meets have also, from similar circumstances, returned to Nature, and the intercourse among them is free and fresh, and released from the barriers of ordinary life. The happiness, long forgotten, of finding enjoyment in others, is recovered ; and even the poor egotistical hypochondriac goes out of himself and interests himself for others ; the simple and powerful impressions act, as it were, soothingly in allaying his constant psychical irritation. Even those suffering greatly experience this benefit. To them the principal thing in this respect is the distraction of the mind from circumstances which either produced the illness, or by their depressing uniformity checked the patient's compensating power necessary for recovery. At home, in the routine of ordinary life, the sick man's suffering is for the most part the central point of his existence and of his interest ; all his wonted relations to surrounding circumstances and to his fellow men are distorted by the illness ; everything that surrounds him painfully reminds him of the conditions and pleasures of healthful life, and makes him feel his outcast position from the standard of existence. Thus at home he ever falls anew back into himself and into the consciousness of his suffering, which, filling him as with the painful feeling of an unfortunate exception, grows into an affection of the mind. At a spa, however, where the entire life is directed to one point, namely, to sickness, the sick man no longer feels himself

such an alien in life; his connection with the world appears to him no longer as a hostile exception, but as a kindred and intimate relation. His fellow guests are the mirror in which he beholds his own fate objectively, as something external to him. He sees no longer merely himself ill, but mankind; he feels himself as a portion of sick humanity, and a fellow-bearer of the general fate of man; and in this way he feels reconciled to his lot, which he could not be in the misery of his isolated sphere of existence. And thus, too, hope arises in his mind more freshly and strongly than at home; it is frequently in direct proportion to the novelty and extent of the undertaking, to the distance from home, from familiar beings, and from the accustomed physician, and to the sight of companions, who in the very same place are seeking help, cherishing hope, and finding improvement and recovery.

Although we do not know the immediate connection in which these purely psychical influences stand with the different vital functions, still their prompt and decided effect on nutrition and change of substance is a matter of the widest and commonest experience; any situation which materially and permanently depresses the mind exercises speedily and often immediately a pernicious influence on sanguification, on the nutrition of the tissues, and on the change of substance; with the disburdening of the mind, power and health are often at once restored, provided the cause has not been too long at work, and has not produced permanent disturbance of the organs. The elementary effect of psychical influences we must partly seek for directly in modifications of the innervation of different nerve-centres, especially in abnormal innervation of the organs of digestion and assimilation, of circulation and respiration; and partly indirectly, especially in superficial respiration, which, after a primary and transitory excitation, accompanies depressing affections of the mind of longer duration, and which is explained by the diminution of the impressions through the senses, and the abstraction of the preoccupied mind, just as in long-continued reading and making music, and even in eager listening, the respiration is affected, and insufficient

Physical
effect of
psychical
influences.

reception of oxygen and giving off of carbonic acid produce insufficient aspiration of blood to the heart, and hence in young people so frequently result in anæmia and chlorosis.

Psychical
advan-
tages of
travel em-
ployed for
accurate
indica-
tions.

In many cases we may be contented with the prescription of travel in general ; in others, however, more definite statements and more accurate indications are involved ; a certain measure of changed mental activity is necessary, a plus or minus as compared with the usual habits ; and the nature of the mental employment must be altered. Here also it is not possible to give rules, but only examples ; and if we linger longer on this point, it is because in this matter unspeakably many and great errors are committed, since a generation of physicians has arisen who despise psychological study and psychological interest in the human race as superfluous and unseasonable.

General
relation of
mental to ph-
ysical
activity
and develop-
ment.

In the first place, an *error* is to be corrected which is widely spread with regard to the influence of mental activity upon the condition and development of the body. Mental and physical activity are often placed in opposition to each other as hostile influences, as if the one activity took place necessarily at the expense of the other, and mental development took place at the expense of physical. This fallacy has gained ground, because a physiological law has been made from one-sided abnormal and pathological phenomena. The contrary is the truth. The healthiest people, *i.e.*, those who by the fulfilment of *all* the claims which may be made on the development and achievements of a man, represent the prime of humanity, are in nowise those only physically active, but those who harmoniously develop and display both sides of life, the physical as well as the mental ; the history of mankind has not been made by the merely digesting portion, but by that part of the human race which has developed the climax of human organisation, the brain and the mental life, to the highest point possible under given circumstances. Truly healthy is that man alone, who on the one side has developed his mind as far as its innate talent and his own special circumstances in life allow, and who on the other side employs his physical functions sufficiently to duly support the brain for its

necessary round of mental life. For this task, however, the robust power of the country labourer or the sailor is in nowise required, but a medium, and often even a slight amount of the physical functions and support is sufficient. Since we know that mental activity often exercises an advantageous influence on such eminently physical functions as the secretion of urea and the formation of carbonic acid, we can no longer wonder when we find, especially among the intellectual classes, great health and extreme age, and that highest result of health, namely, beauty. Whatever is here lacking in physical activity, is compensated for by activity of brain, and the latter acts vicariously in the place of the former.

The above-mentioned error arises, as we have said, from the observation of abnormal conditions and exceptions, in which the mental development and exercise of a youthful individual is either in itself carried to excess, or is provoked to the neglect of the physical development; or of cases in which an adult, neglecting the requirements of his body, imposes upon himself excessive mental labour at the expense of the body, and this habitually; and here the question always arises as to the share which the *physical inaction* necessarily combined with study has in its pernicious effects. For there are many cases of this kind which have really nothing to do with mental labour; the anæmic sickness and the feeble nutrition of important organs among teachers, civil officials, and persons constantly confined in close rooms, proceed in the greater number of cases only from the sedentary and miserable mode of life, often combined with scanty nutrition; excessive mental labour is often spoken of with reference to them, while in reality they are restricted to monotonous and mechanical routine work, and their mind, on the contrary, lies fallow, because it lacks the excitement of novelty and the creation of ideas of its own. From the narrowness of their thoughts, these individuals may be characterised as intellectual artisans, and when they leave their limited sphere, and betake themselves to travel, they seek not *relaxation* but *incitement* for their brain, and it is an erroneous measure when such people are sent to small and quiet health resorts,

Supposed
mental
effort
of persons
mechanically
employed.

Diversion
of mind.

where they again only find limitation, that is, the limitation of the few ideas and interests which fill the small circle of an invalid society. Such invalids require far more *diversion*, i.e., manifold and superficial excitement; in this respect, therefore, a journey is often more beneficial to them than a course of waters; and if the latter be directly called for, a much frequented place, affording plenty of amusement, is to be preferred to a smaller and quieter one.

Collected-
ness of
mind.

The reverse is the case with persons who are accustomed to lead a diverting and busy life in a large and manifold sphere of ideas and interests, as, for example, princes, statesmen, manufacturers, and physicians in great practice, &c. These very often do not require diversion, but *collectedness of mind*, i.e., the temporary restriction of their interests to a smaller circle of men and things; and if such patients, compelled by certain indications, visit frequented and noisy spas, they live there for the most part, in obedience to their psychical necessity, in great seclusion, and have daily intercourse with but few persons. Above all, it is intercourse with Nature which best suits the need for collectedness of mind; and those especially who give, so to say, their entire being to their work, find in Nature, who is ever the same and ever true, that calming influence which they seek for in vain among men, and especially in the 'world.'

Individual
indica-
tions
of psy-
chical in-
fluences.

It is thus easy to perceive that, with regard to the needs of both the mind and the disposition in prescribing a course of baths or travel or a climatic remedy, the indications must be taken from a psychological apprehension of the individuality of the sick person, and that we may in nowise be satisfied with the pedantic rule of presenting only such new conditions to the activity of the brain as are opposed to its habit. Every rule which might be laid down on the subject requires qualification. As in physical, so also in mental diet, it is not every man who can bear a sudden and total change; many have so accustomed themselves to the enjoyment of coffee, tea, tobacco, and spirits, that these things have become integrant vital stimulants to them; and the physician, whom practice has

taught, knows that he must not violently reform such habits. In the same manner there are men who could not endure, on a journey or during a summer course of baths, to let their mental activity lie fallow, for this has become to them likewise a necessary stimulus.

In addition to the psychical influences which the condition of the sick man when travelling induces, we must consider the very important element of *increased bodily exercise*, though this in severer cases is only passive. Bodily exercise. It calls into play all the parts of organic life, the consumption and increased growth of the muscular substance, which is shewn by the improving muscular power, and by the increase of the urea and of chloride of sodium in the urine; the stimulation of the process of respiration, the revival of which is not fleeting, but becomes permanent owing to the gradually exercised and improved power of the respiratory muscles; the greater activity of the glandular organs and of the skin; the increase of hunger and of ingestion of nourishment, and the corresponding increase of digestion and of assimilation of food; and as the result of all this, a better nutrition of the blood and tissues. At the same time, in general the appetite is not excessive, nor is the weight much increased, for with the secretion, the absorption and consumption of the hydro-carbonates are augmented; and hence travelling makes a man *strong* but *not fat*. The excitement of the day is moreover followed by healthy calming sleep, which nightly fulfils its double object of lulling the activity of the brain and of renewal of organic matter. As regards the *alvine evacuations*, they are generally in travelling less moist and even diminished in quantity; at first they are often suppressed, partly because the more complete digestion leaves less matter to be excreted, and partly because the increased absorption abstracts the water, and this effect is produced even by the passive movement of driving. In addition to all this, as for the sake of completeness we will briefly anticipate, we may mention the increased use of water and its immediate effect upon the change of substance, the rich enjoyment of the air, and the hardening

of the skin against cooler temperatures and uncertain weather.

CHANGE OF DIET.

General
import-
ance
of dietetic
treatment.

DIET, both in life generally and in medical treatment, is often the most important of all agents. *Dietetic treatment*, which in numerous cases is sufficient for the cure or amelioration of chronic illnesses, produces an effect in general in three ways.

1. It exerts its influence by enforcing the giving up of all pernicious dietetic habits, and to this head the greater number of cases belong.

2. The second kind of dietetic treatment starts from the experience that many constitutions are better for a time, and more easily recover from chronic illness, when their life is regulated by very simple and uniform conditions, either in order to simplify the work imposed on the sick stomach itself, or, by lightening the work of digestion and assimilation, to set other sickly functions at liberty. In the latter respect we may mention as an example the use of *buttermilk*, which was employed successfully by the great practitioner Krukenberg, not only for cardialgia, but also in many cases of severe neurotic complaints, hysteria, spinal irritation, catalepsy, and the action of which must be viewed as a cure by nature, or spontaneous cure, aided and rendered possible by a diet which from its lightness and uniformity reduced the work of organic life to a minimum. A similar purpose is effected by the *milk cure*, especially in phthisical tendencies, in the commencement of phthisis, and in many heart-complaints, where it is necessary to make as little claim as possible on the powers of the organism in the indispensable work of the appropriation of organic matter. Both diets of buttermilk and milk have, moreover, their direct effect upon the stomach and upon its morbid conditions, and the same may be said also of soup diet and of other dietetic remedies.

3. The third kind of dietetic cures has a definite object in view, namely, to make use of special substances

for special purposes. *Cod-liver oil*, for example, is intended to supply the body with fat, for which purpose the iodine contained in cod-liver oil has so far a doubtful significance, as it sometimes amounts to no more than $\frac{1}{8}$ gr. per ounce, and at other times the cases in which the remedy produces a favourable effect do not always correspond with the indication of iodine. The *grape* and *fruit* cures, especially with apples and cider, supply the blood with alkalies combined with vegetable acids, regarding which it is well known that they make the urine neutral and alkaline by the secretion of alkaline carbonates. The *whew* cure is a kind of mineral water cure, with sugar of milk and alkaline lactates, and the like. Lastly, the introduction of the Schroth cure, with its modifications, furnishes a proof that in many cases any thorough change of diet, however nonsensical in a physiological point of view, is able to place the organisation, as it were, under a proper training, facilitating important functions, as in the milk and buttermilk cure, and rendering possible the removal of the products of illness; in such changes, it is of course of great consequence that the alteration in the diet should be thorough and permanent for some time if it is to bring about any result; and this explains the fact that these cures are more easily carried out by charlatans and quack-doctors, who are better able to impose on the superstition of the public, than by rational and honourable physicians.

Some amount of alteration of diet is necessarily combined with travel and a change of residence, and it is an acknowledged fact that any dietetic prescription is more easily and effectively carried out during a course of baths and waters than it can be at home, amid the usual habits of life. Pernicious habits cling much more closely in the daily routine and amid the ordinary affairs of life, than they do abroad, amid novel circumstances, which claim all the interest of the invalid. The uniform and regular return of the daily phases of life, and the domestic influences, make a thorough reform in the habits of life very difficult to most people; and for this reason, this is gladly undertaken and consistently carried out by many under

Change of
Diet.

circumstances *where everything is new*. Travel withdraws a man from all his wonted habits; the undertaking is great, and it is combined with special sacrifices and with special hopes; new scenes, new people, new arrangements arise; a new physician carries in his very presence hope of success, the pretension of special influence and the prospect of special achievements; and the new prescriptions are, moreover, often supported by the necessity of yielding to the mode of life established at the place.

Impossi-
bility of
general
dietetic
rules.

It is quite impossible to give general rules for diet during a course of waters and baths, as each sick person has his own individual requirements. Even the most general and current maxims admit individual exceptions, as, for example, the injunction against late and *rich suppers*, as there are many sick persons, especially those whose nerves are affected, who would in vain attempt to sleep if they did not go to bed during the process of digestion, and many who do not sleep at all without a glass of wine or beer as a *sleeping draught*. The same is the case with the *afternoon sleep*; although in general the healthy person does not require it, yet there are many sick people, especially when their sleep at night is uneasy, who are obliged to take mid-day rest, and these should not be deprived of it, supposing that it does not produce unpleasant symptoms, such as violent palpitations. The usual restriction of the *meals* to the favourite number of three, namely, breakfast, dinner, and supper, is likewise not an universal rule, as there are people, especially those suffering from nervous diseases and from anæmia, whose organisation is almost like that of a child, and who also require more frequent and smaller meals.

In any case no general rules can be given for the diet of the sick, but the axiom alone, let each see what is good for him, and one thing does not suit all. Of course, in taking different waters different things are to be avoided as injurious, and in all courses of treatment indigestible food especially; the conditions of each individual case require, moreover, special rules of diet, depending for the most part on the state of the patient, and in a slighter degree on the effect and the chemical constitution of the

mineral water. Among the most general rules of diet during water cures a few prejudices still prevail, which must be all the more vigorously rejected, the more obstinately they are adhered to in spite of better experience, namely, the prohibition of vegetable acids during a course of alkaline waters, and the prohibition of butter in most water cures.

The prohibition of vegetable acids, and especially of acid wine, during the use of alkaline waters, as, for instance, Ems, Obersalzbrunn, and Vichy, springs from the period about the end of the seventeenth century, when the chemical nature of the main element of those springs, namely, carbonate of soda, was discovered, without any knowledge being possessed of its physiological importance on the organisation and the change which it experiences on its passage through the body, and, moreover, without any conception of the chemical process of digestion generally. The effervescence and escape of carbonic acid on the mixture of an alkaline carbonate with another acid was the fact which caused physicians strictly to forbid wine and vegetable acids, during the use of soda waters, in order that the carbonate of soda might pass from the stomach into the blood undisturbed. The theory on which it rests is as crude as it is false, and is opposed, not merely to all physiological facts, but even to the most general experience, according to which vegetable acids, unless special contra-indications exist, in no wise interfere with the effect of alkaline waters. The carbonate of soda meets with acids in the gastric juices and in the small intestines, which are far stronger than carbonic acid (lactic acid, acetic acid, &c.), and which at once decompose the carbonate of soda and transform it into other salts; nevertheless, we find it again in the blood and urine as carbonate, just as we meet with it in the ashes of the blood as the result of combustion. The alkaline salts of vegetable acids are, however, found just as much as carbonates in the blood and urine as the alkaline carbonates, if they are taken in abundance, because they undergo the same oxydation in the blood.

The prohibition of vegetable acids and wine.

Still more astonishing is it how the prohibition of Prohibi-

tion of
butter.

butter when taking alkaline mineral waters could have maintained itself so long, and could have even extended to most other water establishments. Even at the present day, most of the mineral springs emulate Carlsbad in the interdiction of butter, as if to have their share in the weighty authority of this chief of mineral springs; even at the present day, in spite of the sober judgment of many intelligent physicians, this prohibition is very generally in force, just because the prejudice has taken fixed root in the public mind as an hereditary axiom. It is a matter of course that in many cases a greasy diet is forbidden; but the prohibition of butter does not refer to this, but rather to the chemical relation of the fat of butter to the alkali contained in the mineral waters; a supposed saponification of the alkali with the fat is to be avoided. More is required for saponification than the mere contact of butyric acid with alkalies; the digestion of fat, *i.e.*, the formation of the alkaline salts of fatty acids, only takes place in the small intestine, after the mineral water has been either long absorbed or long removed from the bowels, or at any rate has reached the large intestine, and all that is not absorbed of the alkali falls under the influence of the bile-fat. Moreover, all the fat which is superfluous passes away with the excrements; and lastly, it is only an excess of fat that is pernicious to digestion, whilst a moderate supply of it in the gastric juices accelerates the transformation of proteinaceous substance into peptone, *i.e.*, into new and more soluble matter. The exclusion of fat is senseless, for, as we mentioned above with regard to vegetable acids, alkalies combined with fatty acids reappear as carbonates in the blood and urine. The sick person ought in general to be nourished during his course of waters, and his digestion ought to be promoted, and for this fat is requisite.

CHAPTER II.

COUNTRY AIR AS A REMEDY—ITS PURITY AND ITS
DIFFERENT DEGREES OF MOISTURE.

WE understand by country air, as regards our present subject—*i.e.*, the enjoyment of fresh air in travelling and in balneotherapeutic treatment—fresh air generally, as opposed to the close air of towns and rooms, and the atmosphere of the various health-resorts, whether they are situated in the mountains or on the plains or by the sea-shore. The powerful and often rapid effect produced by the open air upon the healthy and the sick, its tonic influence on health and nutrition, its effect on the formation of blood, which is more certainly and constantly tested than that of iron—these facts require as such no proof, and belong to common experience. Large cities, closely built and badly ventilated dwellings, and crowded work-rooms, are the breeding-places of chronic sickness: the country, the sea-shore, and the mountains are the native home of robust beings, and the removal to fresh air is in countless cases the condition of recovery, or, at any rate, its acceleration. Very frequently we are able to promote convalescence by transporting a sick person from an atmosphere not generally unhealthy into another air, from the mountains to the plain, and *vice versâ*, in fact, even from one part of the plain to another; and yet we are unable to conceive the physical effect of this change of air, or to conjecture it with any probability. Dr. Gutike, who recently died at Halle at an advanced age, an honourable veteran of the empirical Hippocratic school, made some valuable observations on the subject during his long life. If a sub-official, he says, who with his small salary and numerous family scarcely rises above the existence of the proletariat, be removed from Magdeburg to Halle, or *vice versâ*, the scrofulous delicacy

General
value of
change of
climate.

in the winter a certain air is permanently removed, and the result is a certain degree of purification and fortification of the air, and the air is thus the worst agent of disease and of the cause of the most common epidemics. This difference of air is of great importance, partly because it is the cause of the air being more agreeable of itself to the human system, and partly because it manifests the importance of the air and the influence of the atmosphere.

Every air
has

In considering the influence of the air and the air we are, indeed, under the necessity of referring to the somewhat vague idea of the air being more or less pure, the existence or the absence of certain elements, with the relative proportion of the various constituents of the atmosphere, of the oxygen and the nitrogen, and the very varying influence of the air, in the country, season, and mountain, and even in various geographical situations. When, on the other hand, we call the air pure, in account of its greater density, under a higher and the higher mountain air, in account of its being purer in oxygen, this may be partially correct; for the question arises whether we are thus measuring regular processes by the mechanical properties: it has been asserted, that it is an axiom, that in high situations less oxygen is received into the blood, but we shall see in the third chapter that this is neither proved nor probable.

If, as in the instance mentioned above, small and intangible changes of air are not without an influence, the result is of course all the more thorough, the greater or closer the town in which the sick man had his home, and the more unhealthy the abode in which he had to spend a considerable portion of his daily life. The accumulation of refuse in towns, its stagnation and the retention of decomposed matter, the close crowding of streets and houses, and the limited space of the different abodes under one roof, impede ventilation, the supply of fresh air, the carrying away of miasma, in a word, that destruction in the widest sense of the word, which results from the detached situation of dwellings in small towns and in the country.

From

The most important agent in the purification of the

air seems to be the quantity of *ozone* contained in it, *i.e.*, that form of oxygen which possesses the property of destroying the gases produced through organic and inorganic decomposition, and mingled with the air, and in the conveyance and transmission of which form of oxygen the chemical function of the blood-corpuscles seems to culminate. Although the observations on the subject are still very far from coming to an approximate conclusion, still, on the whole, the relation of the larger and more constant amount of ozone to the salubrity of the air is well ascertained, and the chemical properties of ozone are, at any rate, experimentally well known. The greater abundance of ozone in fresh air (in contrast to the air of towns and close rooms) is explained by the greater abundance of the most important sources of ozone, namely, sunlight and vegetation; the former probably determines the amount of ozone in the sea air, and the latter that in forest air. Whether the diminished density of higher strata of air, apart from vegetation, has an influence on the amount of ozone, has hitherto not been ascertained, nor has the influence of moisture in the air been accurately determined. The most general opinion, which can, moreover, bear the most careful criticism, is based meanwhile on three points: 1st, the proved salubrity of an air almost always accompanies a high and constant amount of ozone; 2nd, ozone purifies the air from hurtful gases; and, 3rd, the amount of ozone in the air inhaled corresponds with the supposed most important function of the blood-corpuscles.

Another criterion for the purity of the air is its greater or lesser freedom from particles of *dust*; and in this respect greater importance must be attached to organic dust than to inorganic. The former, which is visible as motes in sunbeams, and is often mingled with the air in immense quantity wherever human beings live closely crowded together, even diffusing a specific smell, according to the author's observation, and causing a distinct taste on the tongue, consists of fungus-spores, which by many investigators are considered as the main vehicles of

Organic
dust.

miasma.¹ Certain it is that the perniciousness of the air, as proved by experience, increases with the closeness of the dwelling in proportion to the number of its occupants, that in the same proportion the admixture of organic dust increases, and that these influences combined become most strikingly apparent when dampness of walls is added to closeness of space; and it is this addition which gives rise to the suspicion of the spread of miasma by means of fine particles of dust, and this not merely in acute infectious disorders, but even in chronic illness, as, for example, in arthritis deformans, which is so often observed as the result of damp places of abode.

Products
of decom-
position in
the air.

Somewhat more within the range of our comprehension is the injurious effect of the gaseous substances arising from decomposing organic bodies, of carburetted hydrogen, phosphoretted hydrogen, sulphuretted hydrogen, ammonia, &c. It is true we know neither the special character of their injurious influence, nor their different relations to the production of distinct sicknesses; but the fact is indisputable, that a prolonged sojourn in air tainted with them produces a feeling of indisposition, resulting in illness if continued; and this must be explained partly by the impeded process of respiration, and partly by a direct poisoning of the blood. Moreover, very probably, an atmosphere impregnated with such gases retains *specific miasmata*. Most probably, among the component parts of a vitiated air some gases also play a part, which, though well-known ones, are not proved to belong to the infected air. Thus, for example, in a space filled with people, the same component parts of air, carbonic acid, and water, are found increased, as in the saline spray bath at Rehme (see p. 35); but at the same time in the former the senses of smell, and even of taste, are specifically offended, and the effect of the carbonic acid and the moisture is accompanied by nausea, which is very rarely to be observed in the spray bath, in spite of its immense amount of carbonic acid; and to these partly unknown products of organic decomposition must be probably

¹ See Tyndall's lecture on the subject.

ascribed a considerable share in the anæmic and scorbutic condition of those who have to fulfil their business in places thus closely crowded with human beings.

More accurately known are the conditions of the atmosphere which relate to its increased amount of *carbonic acid*. Whether this acid, when it passes into the blood through inhalation by the lungs or by the skin, exercises a positively poisonous effect, or whether it only negatively injures from the fact that it lessens the interchange of gases in the blood and tissues, is not decided. This uncertainty, however, is to some extent indifferent as regards the practical view of the matter. Whether positive or negative, carbonic acid is always pernicious, and even fatal in its effect, whenever it exceeds the limit of a certain amount in the air inhaled.

Infection
of the air
with carbo-
nic acid.

The quantity of carbonic acid contained in the blood far exceeds that in most mineral waters, and compared with it the amount of carbonic acid in the atmosphere is very small. The latter varies between 0.02 and 0.08, and amounts on an average to 0.04 volume per cent., while the quantity in the venous blood, if taken at the lowest statement, comes to 8 per cent. From this we may suppose that variations in the amount of carbonic acid in the air cannot in themselves exercise any essential influence on the expiration of carbonic acid; and with this supposition Vierordt's careful investigations throughout correspond, according to which, in normal atmospheres, the difference in the expiration of carbonic acid exclusively depends on the kind and number of the respirations, on the different periods of day, and on the different states of the individual. The limit at which the amount of carbonic acid in the air begins essentially to impede the excretion from the blood, seems, from the experience of the general state of feeling in crowded rooms, to begin at an amount of $\frac{1}{2}$ per cent., and is certainly far outstepped at 4 per cent., *i.e.*, at an amount equal to the air expired; yet the facts relating to the subject are contradictory and capable of various interpretation. Whilst, for example, in spray baths, as, for instance, in Rehme, an atmosphere saturated with aqueous vapour, and filled with 3 to 4 per

cent. of carbonic acid, leaves the general state of feeling often entirely unaffected, the air, on the other hand, of a room filled with human beings at 3 to 12 per *thousand*, is often insufferable; and, as already mentioned, the question arises, whether other changes are not here co-operative, especially the diminution of oxygen and the above-mentioned admixture of unknown gases, or of other organic products of decomposition.

From long continuance in such rooms, the increase of carbonic acid may of course in itself have a direct influence in diminishing the expiration of carbonic acid and the inspiration of oxygen. Exact examinations have been made by Baring.¹ He found in his sleeping apartment in the morning 3 per thousand; in the rooms of the different classes of the gymnasium at Celle, in proportion to their attendance, 2 to 6; even on the landing of the school staircase, in which the corridors and school-rooms opened, 0·8 to 1·3 per thousand; in a judgment hall, 8 to 11·6 per thousand; in the different school-rooms of the town school, 2 to 8, and in the national schools as much as 12 per thousand. In addition to this, in many places there is the lighting by oil, petroleum, and gas—the latter especially, with its products of carbonic oxide and sulphuric acid—besides the consumption of oxygen by the use of material for heating and lighting; and thus it is readily to be explained why a long sojourn in closely crowded rooms must essentially interfere with the process of respiration and the renovation of the blood. Accordingly, we find, apart from the consequences of deficient bodily exercise, teachers, office clerks, and workmen in crowded manufactories, &c., subject to that well-known state of ill-health, which, from deficient nutrition and renovation of the blood, and from impeded exercise and development of the thorax and the respiratory muscles, forms a fruitful source of a great number of chronic maladies, recovery from which cannot be effected by any medical means without removal into a better atmosphere, *i.e.*, without attending to causal indication.

Natural
differences
in the

Those differences in the amount of carbonic acid in the atmosphere proceeding from more natural conditions,

¹ *Schuchardt's Journal*, 1866, vi.

are too little removed from the average standard to be taken into consideration in commenting upon country and mountain air. If we find the carbonic acid of the atmosphere increased with the higher situation of a place, the maximum hitherto observed has never amounted to more than 0.095 per cent., and in the air of city streets it has never been found more than 0.06 to 0.09 per cent.

amount
of car-
bonic acid
in the
atmo-
sphere.

Chemistry is, it is true, silent as regards the specific properties of *vegetation* upon country air: all the more general, however, is the experience that the salubrity of the atmosphere is in direct proportion to the richness of the vegetation. Very probably the resinous evaporations of trees and shrubs, not only of those of the fir kind, possess important influence, for the old employment of resinous remedies has been confirmed anew by the success of the modern inhalation treatment; so also the amount of ozone in the air, and especially the frequent and abundant formation of dew on low and free-growing plants, as the dew absorbs all the ingredients of the atmosphere, oxygen, nitrogen, ammonia, nitric acid, and chlorine combinations. Hence recovery from bad air is more perceptibly and rapidly made in woody districts and in woods themselves than on a barren soil. The comparison, moreover, between the condition of the health of townsmen and that of the inhabitants of the country, speaks plainly enough; national school teachers and office clerks in the country and in smaller towns, although they may lead just the same life as their colleagues in large cities, are far less subject than these to anæmic illness.

Vegeta-
tion.

The influence of the *moisture of the air* upon the animal organisation is, indeed, in some measure, a matter of daily and indubitable observation; but all definite statements as to the place and manner of these various influences, are for the most part only theories based upon inference. The compensating power of highly developed organisms forms a source of difficulty in appreciating the influence of meteorological conditions.

Moisture
of the air.

A primary physical condition of the investigations and speculations on the subject is often neglected, and is not always easy to follow out, namely, the separation of the

Absolute
and rela-
tive
moisture.

two different points of view under which the amount of water in the atmosphere is to be considered, that is, *absolute* and *relative* moisture. Absolute moisture means the amount of aqueous vapour contained in a certain volume of air; relative moisture, on the contrary, denotes the proportion which exists between the given absolute amount of water and that amount of water which the air is capable of holding at the given temperature. In other words, relative moisture denotes the difference between the point of saturation to be reached by the air at a given temperature, and the amount of water really existing; the former being taken at 100, an actual amount of water of 75 is therefore 25 from the point of saturation.

The capacity of the air for containing water is exclusively dependent on its temperature and on its degree of density; the absolute amount of water is regulated by these two influences, and by the territorial conditions of a supply of water exposed to evaporation, and partly also by currents of air; and the relative degree of moisture is the result of all these conditions combined. The warmer the atmosphere, the more water it can absorb before it is saturated, and all the further is an absolute amount of water removed from its point of saturation.

The relative moisture of different districts, and of one and the same district at different times, is dependent, 1st, on the temperature of the atmosphere; 2nd, on its density and motion; and 3rd, on the existence of surfaces of evaporation. It is therefore greatest in winter, when the air is almost completely saturated with aqueous vapour, and least in summer; in the course of a day it is greatest in the morning at sunrise, and least in the hours immediately after noon. Apart from the other two conditions mentioned, namely, the temperature and the surface for evaporation, it is greater in high situations than in lower ones, and in central Europe it is greater during a north-west wind than with any other current of air. The given absolute amount of water in an atmosphere, is, however, *cæteris paribus*, often in inverse proportion to the relative moisture, and in the winter, on lofty mountains and in the north-east wind, it is all the less the

lower the capacity of the air for containing water, *i.e.*, the less aqueous vapour it needs in order to be saturated. Lastly, there are still two physical influences of great importance, namely, the proportion of moisture of the air to the degree of constancy of the temperature and to the radiation of heat: 1st, the greater the relative moisture, the more equable is the temperature, and the less great are the changes of temperature in the periods of the day and in larger divisions of time; 2nd, the more aqueous vapour the air contains, *i.e.*, the higher its absolute moisture, the better conductor is it of warmth, and all the more, therefore, does it accelerate the loss of heat in organic bodies. This last point, however, experiences an essential limitation as regards higher temperatures, which in themselves cause and increase perspiration, but at the same time, on account of their greater relative moisture, check the evaporation of perspiration, and thus repress an important means of refrigeration. Hence the high relative moisture of the winter has a cooling influence, and that of summer a heating influence.

The influence of a greater or less *absolute moisture of the atmosphere*, as far as experience goes, exclusively relates to the *lungs*. People affected with bronchial catarrh, whether this be the result of phthisis or independent of it, find expectoration relieved by inhalation of vapour, and feel in this respect better in the summer, when the air generally is absolutely more moist; or at any rate, on changing a dry for a moist air. Whether for this reason a softening mechanical influence in the water, or a more indirect influence upon the excretion of carbonic acid, is to be assumed, is very doubtful. Importance has been attached to the influence which an absolutely greater or lesser moisture of the inhaled air must have on the loss of water from the lungs; the inhaled air, which under normal circumstances is of a temperature far below the warmth of the blood, is expired with a temperature of 95° to $97^{\circ}\cdot3$ Fah., and wholly or nearly saturated with vapour; the less, therefore, the absolute amount of water in the inhaled air, the more is evaporated within the lungs, and the greater, therefore, will be the

Influence
of absolute
moisture
of air.

loss of water from the lungs. This conclusion, which is not supported by observations and measurements, is purely theoretical, but certainly incontestable; yet it is to be doubted whether this physical relation has really any important physiological consistency; on the one hand, the amount of water in the expired air is not only dependent on that of the inhaled, but, as Moleschott has proved, it is also dependent on the rhythm of the respiration, as by accelerated breathing the percentage of water is lessened; because in this case the air is not given sufficient time to saturate itself with water according to its capacity. On the other hand, however, the loss of water from the lungs seems to be tolerably irrelevant as regards change of substance and the health generally, compared with the secretions of the skin and kidneys, which are to be regarded as the principal compensators of the amount of water in the blood.¹

Influence
of relative
moisture.

The influence of different degrees of *relative moisture* refers exclusively to the *skin*, as the perspiring organ, and as the surface giving off warmth. The more the atmosphere is saturated with vapour, the less water can the skin give off. This is an advantage in very cold temperatures, because the prevention of the loss of moisture also lessens the loss of warmth; for the same reason, however, it is a disadvantage in very warm air, because the urgently required loss of warmth and moisture is thus impeded. This is in accordance with experience in southern and moister health resorts. Favourable as is the effect of the absolute moisture of the air, which in milder temperatures is frequently combined with relative moisture, and the uniformity of temperature thus produced, upon the condition of the lungs, yet the general influence of the damp atmosphere makes itself plainly visible on the sick person's health in symptoms of lassitude, which, however, are of little consequence, and pass away with the variations of the moisture and the currents of air, and are fully removed by a short excursion into a drier air.

Compensa-
tion of

We must again refer to the principle before expressed, that we must not theoretically and partially rest upon the

¹ See the fourth book, respecting the importance of a moist atmosphere in lung-complaints.

absolute effects of meteorological influences, leaving out of consideration the compensatory arrangements of the organisation, and still less those compensations which exist among the physical forces themselves. Such a physical compensation, is, for example, taken into account by Ludwig, and many favourite theories are thus deprived of all foundation. The loss of moisture from the lungs, Ludwig argues, is all the greater, the smaller the absolute amount of water in the atmosphere, and, therefore, in the winter and on high mountains. In perspiration, however, it is all the greater, the lower the degree of relative moisture, at noonday and in the height of summer. The rates of evaporation from the skin and lungs are therefore opposed as to time; the state of the barometer, moreover, in itself exercises an influence on evaporation; when it is low, the formation of vapour is accelerated. Taking all this together, the rapidity in the formation of vapour is increased on high mountains on account of the lower pressure of the air, and lessened on account of the greater relative moisture prevailing there; *so that the result of these combined circumstances may possibly be similar to the condition of things in the plains, where the relative amount of vapour is less, and the pressure of the barometer is greater.*

[Without wishing to form a new hypothesis, we may here mention that, although the loss of moisture to the whole organism may not be greater in high than in low elevations, yet the acknowledged greater loss through the lungs may be accompanied by local effects on certain morbid conditions of the respiratory organs, as well by producing a more active circulation in the lungs in order to supply the required moisture, as also by favouring a kind of drying up of surfaces secreting a morbid amount of mucus and pus, and also of moist exudations within the tissue. Possibly the improvement in many cases of chronic catarrhal pneumonia may be promoted by this increased afflux of blood and increased loss of moisture.]

A similar importance may be assigned to the *variations* between greater and lesser moisture. In plains, the air is far less exposed to the variations of density and

physical
forces.

Variations
in the
moisture
of the air.

currents of wind than in mountain districts and by the sea : hence the degrees of moisture alternate there far more slowly and rarely : organic life in all its relations is thrown upon the alternate phases of excitement and repose ; and it is a well-known fact that, after a lengthened continuance of a greater degree of moisture, the drooping condition of health and the impeded respiration revive when a gust of wind by the sea or a heavy rain in the mountains brings the lungs and the skin once more into contact with a dry atmosphere. The same may be said also of the contrary ; a long continuance of dryness in the air renders a thorough moistening of it a necessity. Whether the moisture of the air, and indeed in this sense its absolute moisture, exercises any physiological influence by means of *electricity* is very doubtful, as it is only electricity in motion, in the form of a current, and not electricity at rest, which seems capable of producing an effect on organic functions (damp air is a conductor, dry air an insulator). On the other hand, the enervating effect of radiating heat is partly dependent on the moisture of the air, and is greatest at the time when the atmosphere is laden with a considerable amount of vapour ; thus, on an average, some weeks after the summer solstice, and some hours after noon.

CHAPTER III.

WARMTH, AND ITS INFLUENCE ON THE HEALTH OF MAN.

ONE of the most important agents in balneotherapeutic and climatic cures is the warmth of the air. Most of these cures are undertaken in summer, and climatic cures are almost exclusively effected by removal into a milder temperature. In general, the warmer part of the year, speaking, of course, of the temperate zone, is the time of recovery from most chronic illnesses; only a few, such as skin-diseases, some liver-affections, and certain conditions of the nervous system, bear the winter better than the summer. In fact, a general law, or rather a general verdict, can be given as regards the influence of the warmer season on the human organism; but in order to estimate this correctly, and, above all, in order to apply it correctly to the particular case, we must, as in all things, here also take into consideration those physical and organic conditions which counteract the partial influences of different temperatures; and we must especially not wholly forget the considerable difference which exists between the requirements and the conditions of a healthy individual and those of a sick one.

The following remarks briefly comprise all that we know, both from common and clinical experience, and from the best physiological observations, respecting the influence of the warmer season of the year on healthy persons.

Different influences of the warm and cold seasons.

1. Observations and experiments as to the effect of great differences of temperature, suddenly occurring and artificially produced, belong to an abnormal state of things, and have no value in the contemplation of the general condition.

2. The *change of matter* is in general increased in

cold and lessened in heat, and this because of the stimulation given to most of the different functions in cold, and its diminution in heat, a circumstance which is summarily and undoubtedly expressed in the greater and lesser production of warmth.

3. From the stimulation given to the different functions, we must except that of the *skin*, with which the reverse is the case. The skin is more supplied with blood during heat, and perspires far more than during cold; yet this fact loses much in importance as regards the general change of matter, because it is subject to the regulating action of the use of water, varying according to the different requirements, and to that of difference of clothing.

4. The *formation of blood* is more vigorous in winter than in summer; the blood is richer in fibrin and globulin, whilst in summer, compared with winter, a certain degree of anæmia prevails.

5. *Respiration* is in winter more frequent, and deeper than in summer, and in the same proportion the quantity of inhaled air and exhaled carbonic acid is increased; it may also theoretically be inferred that the loss of water from the lungs is greater in cold weather than in warm.

6. The products of the change of substance in the *urine* likewise amount to far more in winter than in summer; the amount of the urine and of its component parts is absolutely increased. However, the plentiful amount of water drank in summer in some measure has a compensating action in this matter.

7. *Nutrition* declines in summer and increases in winter, both in its general result, namely, physical weight, and in its various conditions, appetite, digestion, and absorption. Yet on this point a distinction must be made between healthy and feeble organisms; for to most *sick people* the warm season of the year is the period of better nourishment, for reasons which we shall presently explain.

8. In general, the functions of the muscular and nervous systems, and also all psychical action, are more vigorous in the winter and in the temperate zones than in summer and in the torrid zone; but this statement, too, is

greatly modified in individual cases, as we shall likewise presently show.

The above-mentioned facts *seem* at the first glance to lead indisputably to the general conclusion that in the *colder season* of the year the functions are increased, and the *change of substance accelerated*, while in the *warmer* it is *retarded*. But this statement is only true when we turn aside from all other attendant circumstances; it is only true with respect to healthy persons, and indeed only such as lead the same mode of life in summer and in winter, and even then it is subject to considerable modifications; it does not apply to chronically sick people, and to those persons who are obliged to spend the whole or the greater part of the day during winter in hot and close rooms; with regard to such, indeed, the opposite often is nearer the truth.

The lesser variations of the temperature of the external and internal organs, the lesser quantitative and temporal variations in the loss of caloric, and in many individuals the smaller loss of caloric in itself, in combination with the other conditions of summer life, produce in the warm season and in warm climates, in sick people and in enfeebled organisms, not so much a *retardation* as a *facilitation of the tissue-change and of the functions*, on account of which less claims are made on the consumption of their own organic life and of organic matter. With this facilitation there is often, and, indeed, with sick people generally, combined, not a decrease, but an increase of nutrition and physical weight; and this explains the universal experience that methods of treatment which are intended to stimulate certain parts of the physical frame into special action, are better applied to the feeble organisation in summer, when, from the lesser variations of the temperature of the atmosphere and the smaller necessity for the personal production of heat, it is less preoccupied, and more free for such special action.

General verdict as to the effect of summer heat.

Of course, in the case of many sick and weak people, the slighter opportunity for taking cold in the summer is to be added to the other salutary influences of this season

Choice of the period for baths.

of the year. This consideration leads to the determination of the special time for baths in individual cases, whether the spring with its generally cooler temperature and its greater variations of climate, or the summer with its higher and more constant warmth, or the latter part of summer and autumn with its moderate and less changeful temperature. One maxim must here be specially advanced, a maxim which is rarely mentioned in compendiums with due weight, and which is often wholly neglected by the prescribing physician. An *after-cure*, i.e., a time of repose and modified employment after the baths, is much talked of, and the idea is familiar even to the ignorant; but a *preparatory course of treatment*, or a special preparation, is very rarely thought of, and yet for many invalids this is of the highest importance, as they are otherwise often too weak to bear the fatigue of the journey and the numerous other more or less powerful influences acting on them during the course of spa treatment.

*Influence
of light.*

To light also, and possibly with justice, important physiological effects are ascribed, although these are not yet investigated in their closer causal operation. The idea emanates partly from the well-known chemical effect of light on vegetation and on the colouring of plants, which is perhaps chiefly connected with the formation of ozone; partly from the common experience with regard to the better condition of the higher animals and of man in abundance of light. The psychical influence of light seems also to be considerable. Nothing is known to us of the closer differences that exist, except the greater chemical power which, as is shewn in the process of photography, the light on high mountains possesses beyond that of the sea air.

The weather in general and the influence of the motion of the atmosphere will come under consideration in another place; we will here only mention that they are in summer in the country more favourable to the invalid, than in winter and in confined towns.

CHAPTER IV.

THE DIFFERENT DENSITY OF THE AIR—THE GREATER OR LESSER ELEVATION OF PLACES ABOVE THE LEVEL OF THE SEA—SEA-AIR—MOUNTAIN-AIR—APPARATUS FOR THE COMPRESSION OF AIR.

THE subject of this chapter requires a somewhat detailed explanation, both on account of the importance attached to it by medical practice in modern times, and also on account of the wantonness with which, up to the most recent period, theories for its illustration have been devised and believed. If at the present day our attention is much engaged with the question of the climatic treatment of phthisis in the rarified air of elevated places; if, in opposition to this, the pneumatic cabinet presses forward loudly in praise of its condensed air; if many, and especially English physicians, recommend sea air for the same purpose as we have recourse to mountain air, it is certainly worth the trouble to try whether by means of physical, physiological, and clinical facts any light can be thrown on this confusion of opinions. In order, however, to render this possible, we must for the time entirely set aside all reference to pulmonary phthisis, because the local disease in such cases is too considerable, and presents far too great differences and degrees in different individuals, for such sufferers to afford any reliable material for the formation of a physiological law. We must rather take a *neutral position*, and start with the feeling of the healthy, and of those invalids whose sufferings may be attributed to general weakness of nutrition, and to excitable weakness of the nervous system, but whose lungs are not diseased. With reference also to the physical material, we must leave the field of theory hitherto cultivated in preference, to take the neutral ground of

Importance of the subject.

facts, and thus learn that even some views regarded as axioms melt away into airy hypotheses and theoretical misty creations. 'The more rarified the air, the more must a man inhale of it;' this statement, for example, is one of these airy creations, in spite of its apparent logical cogency; and we shall shew at the close of our discussion that it is untrue when viewed within those limits of the density of the atmosphere with which physiology and pathology and therapeutics are concerned.

Current theories.

We must first premise that men and animals endure great extremes of atmospheric pressure without any great interference with their state of health, but that often even slight variations of the barometer are not without an influence on their general condition, and this all the more perceptibly the more quickly the variations occur. Whilst men live and work at an elevation of 15,000 feet above the level of the sea, and also under the pressure of two atmospheres in the diving bell and other condensing apparatuses, the most important organic functions are affected by slight variations in the barometer of a few millimetres, and this most perceptibly of course in sensitive and so-called nervous natures, whose state of feeling is itself often even a kind of barometer for the change in the density of the atmosphere.

The symptoms with which such organisms respond to sudden variations in the barometer relate to the greater or lesser freedom of respiration and innervation, especially of the pneumogastric and sympathetic nerves; and, as these functions are dependent on the continual refreshment of the blood, it is probable that in these slight variations the separation of the carbonic acid and the modified appropriation of oxygen form the point of attack on the state of the organism. Starting from the fact that a more rarified air afforded the lungs less oxygen and somewhat less carbonic acid, it was concluded that in rarified air less oxygen was inhaled and less carbonic acid was exhaled, and certain phenomena were brought into connection with this theoretic conjecture, as though the matter in question were one of the best authenticated. In the same way, from the mechanical action of the diminished

and increased pressure of the atmosphere, superficial mechanical conclusions were drawn; and on these was founded, without further ceremony, the theory of rarefied air as well as, in recent times, that of the dynamics of condensed air.

Vivenot, for instance, one of the most recent writers on the pneumatic apparatus, arrives at the conclusion with regard to the climatic treatment of phthisis, that a rarefied air deficient in oxygen is pernicious in cases of phthisis as producing an artificial dyspnœa and an increased desire for oxygen; in lung-diseases, he argues, it is only by condensed air that the dyspnœa can be diminished and the tissue-change retarded! When, however, we see that at Davos and other elevated places people suffering from phthisis feel themselves better and recover, when experience knows nothing of dyspnœa in such places, and when the experiments of Tyndall and Frankland overthrow the whole theory of this supposed desire for oxygen, we must learn from this that these supposed accurate views no less readily engender premature judgment, than the blind conjectures of an age ignorant of natural science.

Just as the remembrances of youth cling most to men, so those views which first brought organic occurrences into connection with physical facts have often a tenacious value, because they illumined the childhood of theory with the first feeble light of anticipated truth. And it is just theories such as these, which, according to Tyndall's striking expression, have a narcotic effect on the mind that has grown accustomed to them as to the use of brandy, and feels itself excited and annoyed when the imagination is deprived of its stimulant. Especially, however, the necessity for sober criticism obtrudes itself with regard to the manifold therapeutic results boasted of by many of the possessors of *pneumatic apparatuses*, and the brilliancy of which appears in a very suspicious light. The palliative effect of the apparatus is tolerably ascertained only with regard to attacks of asthma, and this is easily explained, according to Niemeyer, by the tension of the

gases which we inhale. 'The greater this is, all the greater quantity is admitted into the blood; a moderate hindrance to respiration can thus be compensated by stronger tension of the gases respired.'¹

The first important observation on the subject was made more than thirty years ago, on a large number of working men in France, who bore a pressure of two or three atmospheres without material inconvenience. More recent observations, however, made by Bauer in America,² exhibit striking phenomena. On sudden transition from air much condensed into ordinary air, many attacks of sickness and death have occurred, with the symptoms and the post-mortem appearance of hyperæmia of the brain and spinal marrow, although no change had been found in the pulse. This latter statement makes the whole matter suspicious. Panum, an impartial observer, discovered that in condensed air more carbonic acid was evolved by equally strong respirations than by the same persons while at rest under usual pressure; that the quantity was, in fact, as much as in moderate walking, but not more, and not for any length of time. Liebig, on the other hand, found the quantity of carbonic acid somewhat diminished. A lasting change seems to occur only in the capacity of the lungs, in consequence of the pulmonary gymnastics called for by the apparatus, and to this the final effect seems to be limited.

Criticism
above
theory.

Credible observations in the diving-bell, and the experiments of Jounod, shew sometimes an unaltered and sometimes an increased frequency in the pulsations, and it is only the possessors of the pneumatic apparatus who have found the pulse constantly retarded in their observations; all the other facts they have adduced as to the physiological effect of this apparatus may be designated as inferred from the presupposed mechanism of the physical processes. Thus the assertion that the amount of carbonic acid expired in condensed air is increased, is very doubtful.

¹ Niemeyer, *Pathologie*, viii. ed. i. p. 99.

² Schmidt, *Jahrb.* vol. cxlviii. p. 64.

As regards the chemistry of the respiration in great density of atmosphere, there is but one fact for our present consideration, namely, that condensed air conveys absolutely more oxygen to the blood; and the question arises, where and how is this plus of oxygen expended? Formerly, it was believed that the oxygen inhaled is exclusively applied to the decarbonisation of the blood. At present, however, we know that oxygen has its important, necessary, and constant office in the *tissues* and their juices, as well as in the course of the blood, and we meet with it again in the atomic weights of the highly oxidised transformations of albuminous substances, such as kreatin, inosin, lithic acid, urea, and others. G. Liebig discovered that the muscles inspire oxygen, and Valentin perceived the close relation of this to the carbonic acid yielded and the work performed by them. H. Davy observed that, after prolonged inhaling of an air rich in oxygen, most of the functions of life go on with increased energy. Marchand, in his experiments, came upon the explanation of this fact, by shewing that the greater part of the plus of oxygen inhaled was not spent in the formation of carbonic acid, but was retained in the blood. Hervier and St. Lager observed that the expiration of carbonic acid became increased for several hours only *after* the air-bath in the pneumatic apparatus. It may, therefore, be assumed as probable that the plus of the inhaled oxygen is expended in the tissues and juices. There are some facts which seem to be in favour of this view, namely, the increased feeling of strength at the sea-shore and also after the use of the pneumatic apparatus, and the increase of urea and sulphuric acid, with diminution of earthy phosphates, in the urine.

The
respiration
in con-
densed air.

The contrary side of the investigations on this subject, namely, the state of animals when exposed to air rarefied under the air-pump, corresponds pretty generally with this statement; namely, the movements become indolent, and the respiration is diminished almost to asphyxia; but, even after half-an-hour's stay in the vacuum, the animals often return to life as soon as they are again allowed respiratory air. Here, however, we meet with

Condition
of animals
under the
air-pump.

experiments which afford a striking evidence that the physical element does not always necessitate the physiological element, because the regular conditions of life come forward as independent agents in the product of phenomena. Prout discovered that the secretion of carbonic acid increases in moderately condensed air, and on the other hand diminishes in higher degrees of condensation; and the very important experiments of Hoppe prove that small animals remain in good health for a long, though not always equal period under the air-pump, until they quickly and even suddenly die (small sucking animals at a pressure of 50 millimetres, and birds already at 120), and that then small gas-bubbles are found in the blood. He also succeeded in reviving asphyxiated animals by introducing hydrogen gas, thus restoring the pressure without supplying oxygen. We have, therefore, increased respiration of oxygen as the effect of condensed air, while as that of the contrary state of atmosphere we have also the *diffusion of gases*, and thus the practice of sober observation presents a very different aspect to the creation of theory!

If we now pass from the abnormal conditions of artificial experiments to those afforded by nature with regard to variations of atmospheric pressure, we meet unfortunately with a great deficiency of exact and measurable observations. An accurate and experimental comparison between the state of one and the same man on the seashore, and on the mountains at a considerable height, has, so far as we know, never been attempted; and thus in the explanation of these contrasts nothing remains but the common experience of healthy cases and the clinical observation of sick ones, if necessary, with the critical application of the theories just authenticated; and here also we meet with considerable contradictions between facts and their attempted and possible explanations.

The following points are worthy of notice, partly for the practical view of the question, and partly as starting points for further investigations.

1. As the condor (according to Humboldt) endures within a few minutes a change of between 12 and 28

inches of atmospheric pressure, so man can live without uneasiness from the level of the sea to an elevation of 10,000 and even 13,000 feet.

2. We possess no satisfactorily based experiences with regard to the different physiological state and its various causes in one and the same person at different elevations; and this is especially the case with regard to the frequency of the pulse.

3. The assertion that with increased atmospheric pressure more carbonic acid is exhaled, and by lessened atmospheric pressure less is expired, is, as we have already seen, nothing but an hypothesis.

4. The actually existing plus and minus of oxygen inhaled in condensed and in rarefied air cannot accordingly be reckoned with regard to its further fate according to the mechanical theory of respiration, but must be provisionally taken into account as an agent in the change of substance going on in the tissues and fluids; and thus, so far as other influential forces, besides the weight of the air, do not come into consideration, the theory would result that removal into a high situation lessens the change of substance, and into a low situation increases it, if an irrefragable physical consideration on the one side, and clinical observation on the other, did not oppose the universal acceptance of this statement. In the favourite theoretical speculations, the distinction, for instance, is forgotten, which must be drawn between the oxygen contained in the air inhaled and that actually received into the blood, the average relation of which is about 20 to 15 volumes per cent. Of the oxygen, therefore, existing in the air only 25 per cent. is on an average used for respiration, and this average number itself has been obtained from most varying amounts in different cases of observation. From this proportion it follows that, at elevations which hitherto have been proved accessible to man, we find in the air probably a still more than sufficient quantity of oxygen, and that the air at these elevations is not so greatly rarefied as to retard the change of substance from a deficiency of oxygen. We shall, however, at the close of this chapter, adduce those clinical

facts which furnish a proof that both extremes, both sea air and high mountain air, promote the change of substance, but each in its own way; and we shall then also be in a position to support and illustrate the clinical view by the latest results of physical experiments.

5. Besides the degree of the absolute density of the air, a very important force, namely, the relative variation of this density, must be taken into consideration. The state of the barometer has its regular variations in the course of the day and the seasons of the year; in addition to this, there are the irregular variations which occur more rarely in vast plains and more constantly on the sea-shore and on mountains: and these variations themselves are a necessity for our well-being; just as we cannot bear either constant dryness or dampness, we cannot endure a very constant state of the barometer without feeling our respiration or the condition of our nerves affected. If we reflect that, according to G. Lehmann's observations, all rapid variation in the atmospheric pressure increases the number of pulsations and respirations, and that organic life is in every respect dependent on a change in the phases of repose and excitement, and indeed of varying excitement, we may suppose that a rapid change in the state of the barometer is more favourable to the more important functions of life than its relative stability; and probably it is this influence which is of the most essential importance in the effect of sea air and mountain air, an effect which harmonises in a certain respect, and this all the more as the variations of density often coincide with those of warmth, moisture, and motion of the atmosphere.

6. These discussions exhibit the deficient character of our knowledge on this doubtful subject, and, while they warn us against receiving frivolous though accepted hypotheses, they invite us to make accurate observations on one and the same individual under different proportions of atmospheric pressure.

Schlagint- Robert Schlagintweit's latest remarks¹ 'upon the

¹ *Zeitschriften Berliner Gesellschaft für Erdkunde*, 1 Band. 4 Heft.

influence of height upon the human organism' likewise prove how far removed we still are from satisfactory knowledge on this subject. weir's results.

We must here confine ourselves to the statement, that his observations relate to the Himalayas and Andes, as in the European Alps, under usual circumstances, the effects of great elevations are not sufficiently perceptible; that he regards diminished atmospheric pressure as their main cause, but that other modifications of our atmosphere have also a share in them, such as heat and cold, the repose and motion of the air, the degree of moisture and of dryness, the clouds, the proportions of electricity and of ozone, and the amount of carbonic acid. He thinks that possibly, by a long series of observations on great elevations, it may be ascertained under what combination of atmospheric circumstances the influence of elevation expresses itself most, and under what combination it does so least.

If, therefore, with respect to the extremes of specific gravity of the air, such great doubts prevail, we must be all the more reserved on the subject of lesser differences, as, for example, between the sea-shore and a mountain elevation of a few thousand feet.

The observations in the Himalayas and the Andes make any acceleration of pulse at an elevation of 2,000 feet highly improbable, as men become accustomed to extreme heights; and by accurate experiments generally, such as we hope a future not too distant may bring us, we shall probably meet, not with various and striking changes of function, *but with the general mode and manner, in which the human organism accommodates itself to new influences.*

The different processes of this compensation are, as a rule, little or not at all visible. Their general result, however, is apparent enough; and from the way in which clinical experience allots sea air and Alpine air to two essentially different groups of individuals and constitutions, a law is at length produced which for the present must suffice for practice.

Clinical observations of sea air and mountain air.

The effect of sea air is in its main results accordant with that of mountain air; it increases the formation of

blood and nutrition, it increases the weight of the body, it improves the digestive and assimilative powers, it strengthens the functions of the nervous system, and, lastly, as the result of this general effect, it produces natural recovery or essentially aids in the artificial recovery of various chronic states of illness. Still a very considerable difference exists between these remedies, physically opposed as they are, and physiologically harmonising in their effects. The sea air acts more rapidly, the mountain air more slowly; the sea air gives a more vigorous appetite, compels a more increased ingestion of food, stimulates digestion more powerfully, and increases the bodily weight in a perceptible degree in a short time, while mountain air acts in all these respects as a more subtle stimulant; sea air pre-supposes robust assimilative functions, mountain air exerts its gentle influence also on the atonic and catarrhal conditions of the gastro-intestinal canal; sea air demands a certain robust integrity of other functions, especially of the heart and lungs, mountain air, on the other hand, exerts its general beneficial influence also on natures which suffer in this respect from weakness with increased irritability; the sea air easily overpowers persons affected with irritable weakness, while the mountain air has a calming and indirectly strengthening effect upon them. In general, the choice between sea and mountain air is regulated not by the name of the sickness, but by the individual character of the sick individual. Both the sea air and the mountain air operate most plainly and powerfully on the anæmic tendency of chronic morbid conditions; the sea air does so all the more, the more the organs of circulation and the nervous system discharge their functions feebly and bear strong stimulants; and the mountain air all the more, the more easily the organs of circulation and the nervous system respond with excitement and agitation to new and even necessary vital stimulants. There are cases of chlorosis, which bear a course of sea baths equally well and with an equally rapid result as a strong course of iron a course of Bavarian beer, and similar remedies. But there are other cases of chlorosis, and especially of compli-

cated anæmia, which can endure no other treatment than the gentle and scarcely perceptible influence of mountain air. And lastly, by many difficult and easily upset invalids, fresh stimulants, and especially warm baths, are more easily borne in an elevation above their ordinary place of abode; and for such individuals, for example, a bath at Gastein of 95° to 98° Fah. has a calming effect, while this temperature for the same invalids at Teplitz or Schlangenbad would prove a violent and pernicious excitement. The more a high degree of excitable weakness of the organs of digestion and circulation and the nervous system is combined with the anæmia accompanying chronic illness, all the more is the case, to the exclusion of other means, limited to the mild effect of mountain air. The various sections of this work will often, in the case of different illnesses, refer to this most important of all practical points of view; in this place we will only quote one example, which strikingly illustrates this mode of treatment of delicately balanced individuals.

There are in Russia, and especially in St. Petersburg, cases of poverty of blood among young girls of the upper classes, which, from the degree and peculiar circumstances of the malady, represent almost an illness *sui generis*, and which are produced not merely by climate, but by the senseless diet prevailing there (strong tea in immoderate quantity) and by the social habits of life. In such cases of chlorosis and anæmia, often accompanied with extreme uterine catarrh, and with such emaciation that the author has seen them mistaken for cases of progressive muscular atrophy, nothing but a change of climate is able to effect a cure. Sea air and sea baths are very rarely efficacious; on the contrary, the appetite, which had already greatly failed, sinks at the sea-side to the lowest ebb, diarrhoea alternates with constipation, palpitation and the manifold symptoms of spinal irritation overpower the invalid, and the course of baths is after a short trial discontinued. Quite otherwise is it with mountain air; the appetite, although not immense, leads to the consumption of more nourishing food; digestion, the enjoyment of air and light, bodily exercise, in short, all the necessary

stimulants of life, are endured without palpitation, and without exciting the nervous symptoms; in time better blood is formed, the weight increases, though but slightly; and if the residence in the mountains be reckoned not by weeks, but by months, a recovery is effected such as would vainly have been attempted by means of baths and sea bathing, and courses of iron.

[An important point in many such cases is the change of the Alpine health resort about every four or six weeks, as the invalids often become tired of the sameness of the place and cease to gain after a time; but above all it is necessary to avoid fatigue by long tours, the temptation to which is great. Frequently also we find that delicately balanced invalids are unable to bear elevations above 3,000 or 4,000 feet, losing their appetite, or becoming excited and sleepless, while they improve at lower elevations. In other instances, localities situated on the top of mountains or on the slope are less favourable than localities situated in more or less broad valleys, and *vice versâ*. Occasionally only we are able to foretell the probability of such effects, which in other instances we are only taught by the trial in each individual case.]

Character-
istics of
the clinical
effect of
high and
low situa-
tions.

If we now turn from this clinical experience in invalids, and mark the influence of mountain air on the healthy and on the population generally, exhibited, in comparison with the air of the sea-shore and the level lowlands, in less necessity for food, in less necessity for fatty nourishment and for alcoholic drinks, in greater elasticity of body, and in less tendency to the formation of fat, we shall come at length to designate the contrast between the effects of low and high situations, and of condensed and rarefied air, not after the usual theoretic manner above mentioned, as *acceleration* or *retardation*, but as *increase* and *facilitation* of the change of substance and the functions, just as we have recognised the effect of warmth in facilitating vegetative life.

Lastly, it is a matter of course that, with the rarity of the atmosphere in high situations, the other qualities of a mountain climate should be taken into consideration, with essential reference to the individual case; namely, the

dryness of the air, its purity and freedom from miasma, the motion of the air, the abundance of ozone, and other matters. We cannot make up our mind to believe in zones of consumption and of immunity at various elevations.

[Our views on this subject, expressed already in the first edition, have since been confirmed by some of the best practitioners, and especially also in a purely physical point of view by the valuable researches of Tyndall in his classical work on *Heat a Mode of Motion*, and Frankland 'On Combustion in Rarefied Air' (*Proceedings of the Royal Institution*, vol. iii. p. 331, 1862).]

Tyndall and Frankland burnt six stearine candles at Chamouni, and determined the loss of weight that had taken place in them within a certain time. On Mont Blanc, therefore, about 12,000 feet higher, they repeated this experiment in a tent, which perfectly sheltered the candles from the action of the wind, and observed, first, that the brightness of the flame above was much diminished, but that, secondly, nevertheless, the loss of weight in the candles was fully equal on Mont Blanc and at Chamouni.

Physical confirmation of the above characteristics by Tyndall and Frankland.

The energy of combustion on Mont Blanc was, therefore, the same as below. The diminished power of illumination could only be ascribed to the greater mobility of the air at so great a height, and its much diminished density; the small particles of oxygen could penetrate with comparative ease into the interior of the flame, thus destroying its light, and making atonement for the smallness of their number by the promptness of their action.

Frankland afterwards made a series of experiments on combustion in artificially rarified air, and found that even the natural oscillations of atmospheric pressure cause a considerable variation in the amount of light emitted by gas flames; that, for instance, the combustion of an amount of gas which would give a light equal to 100 candles, when the barometer stands at 31 inches, would afford a light equal to only 84.4 candles if the barometer fell to 28 inches; and that each diminution of mercurial pressure equal to one inch corresponds to a decrease of

almost 5.1 units of light, until the barometer stands at 14 inches, below which the diminution of light takes place in a less rapid ratio.

In his celebrated researches on flame, Davy had not overlooked the diminution of light by decrease of pressure, but he had not determined the diminution quantitatively, nor indicated its cause. He anticipated the result of the Mont Blanc experiment, that the energy of combustion is not diminished by the rarefaction of the air.

In experimenting with *artificially condensed* air, the light of the flame was found to become considerably increased, but not the rapidity of the combustion of the material.

While by compressing the air we increase the number of active particles in contact with the flame, we diminish their mobility in almost equal measure, and thus retard the combustion. Frankland, by condensing the air, could increase the pale and smokeless flame of spirit to the brightness of a gas flame, and could at length make it even smoky, the oxygen existing in it being too sluggish to effect the complete combustion of the carbon.

The variations of the light of flames through changes in the pressure of the medium sustaining them, are chiefly dependent, unless hitherto unknown influences are discovered, on the more easy or more impeded admission of atmospheric oxygen into the interior of the flame.

From the investigations quoted, we have thus obtained a tangible, comprehensible, and, above all things, a well-based idea of the mechanical process which regulates the combustion of flame in its modifications by different atmospheric pressure, namely the *idea of the inertness and mobility of the oxygen of the atmospheric air*. And as, from the part which oxygen plays in the blood and juices of the animal frame, we have to do, just as in the combustion of flame, with the interchange between the oxygen of the air and blood, and the oxidable atoms of the blood and tissues, we are fully justified in applying the idea of the physical process to the physiological process of respiration and oxidation, *i.e.*, in other words, in tracing the physiological process by the aid of the physical one, and

in deducing the idea obtained by clinical observation as to facilitating the vital functions and the change of substance, without diminishing the latter, in rarefied air, from the *greater mobility of the atmospheric oxygen prevailing in high situations*. Thus, guided by physical facts, we find our way at length beyond the contradiction existing between theoretical hypothesis and sober experience, and we obtain a point of view, starting from which recent observations as to the effect of high and low situations bring us some steps nearer a practical settlement of the question. To make the way, however, to this point open, it was necessary to disprove the old axiom, surrounded by its halo of patent intelligibility, that in the rarefied air of high situations less oxygen is received into the blood, because this air contains less oxygen.

[Before leaving the subject of mountain air, we must refer to two quite recent contributions. Beneke ('Sea Air and Mountain Air,' *Deutsches Archiv of Klin. Med.*, vol. xiii. p. 80, 1874) has found by careful experiments that the same body of hot water loses its heat more rapidly at the sea-shore than at various elevations in Switzerland, varying from 3,000 to 6,000 feet above sea-level. We may infer from this that under similar circumstances living bodies likewise give off more heat at the former than at the latter, and that the demand for the production of heat is therefore greater at the former than at the latter. Dr. Frankland ('Some Winter Thermometric Observations in the Alps,' *Proceedings of the Royal Society*, vol. xxii. p. 317, 1874) found at Davos, about 5,200 feet above sea-level, at the end of December and the beginning of January very high sun-temperatures, viz., 140° Fahr. (thermometer with blackrand bulb *in vacuo*) from about 9 A.M. till after 3 P.M.; while the shade temperatures were very low. He describes the air at Davos as calm, owing to the absence of local currents caused by heated air, and to the shelter by the mountains from more general atmospheric movements, as dry and clear, abstracting less heat and securing greater transcalency. The height of the sun-temperatures he ascribes, however, not to greater transcalency alone, but in part to reflection from the snow.]

In the causes hitherto discussed, influences have been pointed out which commonly belong to all balneotherapeutic treatment, namely, removal into another mode of life, enjoyment of fresh air, the condition of the sick person as a traveller with regard to his mental and bodily life, warmth, diet, exercise, and the different density of the air in low and high situations. Each of these has in itself alone a salutary influence. To their combination in many cases a great part of the effect of the cure is to be ascribed; and their critical estimation in individual cases is of no less importance, than the selection of the medicinal springs with regard to their physical and chemical constitution. To these important common influences we will now add the effects of water, which in most courses of treatment may be also regarded as a common agent, namely, the influence of the increased use of water and baths of different temperatures. Both these agents belong, at the same time, to the so-called therapeutic and specific remedies of balneological cures; and we have on this occasion to discuss two of the most important methods—the cold water cure, and the thermal spa cure.

CHAPTER V.

INCREASED USE OF WATER.

WE separate the internal use of water from the true *cold water-cure* or hydrotherapy. The indications of the latter refer, as we shall see when this method is divested of the wild belief in an universal remedy, almost exclusively to the external application of cold water. Priessnitz, and his early and especially his dilettante followers, combined with the outward application of cold water its immoderate and excessive use internally, because by the combination of both they hoped to satisfy the belief in their power of working miracles; and this error was the foundation of very many failures and the original disrepute of the system. The internal use is allowed in many cases of cold water cure, either from the individual condition of the patient, or from the sudorific effect of some forms of baths; the time has, however, arrived in which the prescribed increase of water-drinking is regarded rather as a general dietetic measure of itself, and not as an integral part of any hydriatic course.

Water-drinking no integral element of the water-cure.

The *dietetic effect* and the dietetic necessity of the use of water is a matter of the most common experience. Everyone knows that life cannot exist without the use of fluids, and that the instinct of thirst in men and animals corresponds to the measure of that necessity. Equally well is it known that all solid food contains a considerable amount of water; that the temporarily deficient supply of water is adjusted by the diminished secretion of perspiration and urine, and the temporarily excessive supply by the increase of these secretions; lastly, that the requirement of water at meals is partly dependent on the amount of water in the food, and partly on individual peculiarities, but that in general a moderate supply of fluid assists

General experience.

digestion and the secretions necessary to it. Lastly, it has lately become a current maxim, even with the public, that the nutrition and well-being of the body, if this is compelled to inactivity by calling and habits of life, thrive better with a moderate and regulated supply of water, even though not called for by the instinct of thirst.

Physio-
logical
import-
ance of
water.

The results obtained by *physiology* as to the part which water plays in the organism of the human frame, may be comprised for our present purpose in the following statements.

Water in
the
tissues,
the blood,
and the
secretions.

In the first place, water forms an integrant part of all the *tissues of the body*, even the hardest and driest, and its amount rises in muscle to 70 per cent. It also forms the preponderating element as regards quantity in all *secretions*; in the saliva there is an average of 98·45 per cent., in the gastric juice 98·7 per cent., in the gall 86 per cent., in the pancreatic juice 98·5 per cent., in the intestinal fluid 97 per cent., in chyle 90 per cent., in lymph 96 per cent., in milk 87–89 per cent., in mucus 95 per cent., in perspiration 99 per cent.

All these secretions, as well as the water contained in the tissues, may be traced to the blood as their source, and this also contains 76·83, and even as much as 90 per cent. of water; and if we estimate the general amount of blood in an adult person of middle size at 10 kilogrammes, at least $7\frac{1}{2}$ kilogrammes, or about 15 pounds, belong to the water of the blood. Now between the blood and the secretions a constant fluctuation is taking place, and this in a twofold manner; on the one side the water is separated for such secretions as are taking place within the organism, and their water is speedily given back again to the blood by absorption. A great quantity of water is also removed from the body by means of the expiration of the lungs and skin, and by means of the urine; in fact, according to an approximate calculation, 1,600 grammes pass through the urine, 350 through the lungs, and 700 by the imperceptible perspiration of the skin in 24 hours. The three last-named ways of expenditure of water exercise, as already mentioned, adjusting functions; at the same time the perspiration, and still more the urine, carries

off a considerable amount of the products of the retrogressive tissue-change, which are absolutely increased with the increased secretion, and which are only capable of being removed from the organism by being dissolved in water. While we can thus conceive the part which water plays in the organism, essentially as a *lixiviation* of the blood and tissues, still the experiments of Bidder and Schmidt with regard to inanition teach us that we must be careful of taking this idea in a one-sided mechanical sense. With increasing inanition the secretion of urine decreases considerably, and, like all other functions and secretions, shares the decrease in the change of substance which is the necessary consequence of inanition, and at the same time a condition for the continuance of life. As the increased use of water not only increases the quantity of the urine, but also the absolute amount of its fixed component parts, we should naturally suppose, if it depended solely on mechanical lixiviation, that the use of water in inanition would accelerate the consumption of organic matter and emaciation or death. This, however, is not the case; but we find from the experiments of Bidder and Schmidt, that in inanition the body loses fat and albumen far less and far more slowly with a plentiful use of water, although the diuretic effect of water even here manifests itself to some degree. That abstinence can be endured more easily and for a longer time when the use of fluids is rendered possible, has been long known. The explanation of this fact is plain; the lixiviation of the blood and tissues concerns not only such matters as, being unfit for the nutrition of living tissues, are to be removed from the body, but also all substances which, existing as worn-out tissues, are still able to contribute to the nutrition of organic tissues; and from this point of view water obtains the importance of an indispensable element of nourishment.

Lixiviation.

Use of water in inanition.

[Perhaps the more rapid death from inanition, when water is likewise withheld, is partly to be explained by the retention in the body of waste matters, which are removed if a free supply of water be allowed. The acceleration of death would thus appear as allied to uræmia.]

Influence
of the use
of water
on change
of sub-
stance.

The above-mentioned importance of water in the change of organic matter is confirmed by the experiments on *the diuretic effects of plentiful water drinking*, made by Becquerel, Winter, G. Lehmann, Genth, Mosler, and others, showing that by increased water-drinking, not only the quantity of urine, but also that of solids contained in it, *i.e.*, of the products of retrogressive tissue-change, becomes increased; that this increase of solids during 24 hours amounts sometimes to 20 and 24 per cent., and that it consists principally in urea, while the amount of uric acid becomes diminished; *i.e.*, that, with the increase of the most oxidised product of change of substance, there is a simultaneous decrease of the least oxidised, a proportion which, as has been proved, constantly appears in almost all other methods for promoting the change of substance. The increased tissue-change thus effected, is, however, not confined to the removal of the retrogressive products, but the productive functions are likewise increased, for a course of moderate water-drinking leads to increase of weight, and if by an excessive course the weight of the body have been reduced, an increase of weight usually takes place as soon as the quantity of water taken is reduced, and this is accompanied by a considerable diminution of the amount of phosphoric acid in the urine, which is the most important inorganic matter in the new formation of organic cells.

Function
of water.

Accordingly we may sum up the *function of water* as follows—1. That it renders possible the lixiviation of the blood and tissues; 2. That it maintains in due balance the amount of water in the blood at the time of especially plentiful secretions; 3. That it is necessary to the carrying off of excretion; and 4. That it greatly promotes the change of substance, not merely the retrogressive but the productive also, and this not merely indirectly, but also in a direct manner.

Use of
water and
physical
exercise.

If therefore water, a predominant constituent of the blood as regards quantity, can in a passive sense be denominated one of the most important means of nutrition, it obtains by its influence on the change of substance the higher importance of an active means of nutrition, the importance of the most general vehicle for the supply and

formation of new material in the tissues, and for the solution and discharge of the consumed and unusable chemical substrata of organic functions.

Increased physical exercise acts in a similar way (page 25) with the plentiful internal use of water, and the latter may, to some degree, for a time replace the former in those who are unable to take exercise.

Increased diuresis appears to be the principal means for the discharge of an excess of water. The expiration of water from the skin and lungs is almost exclusively dependent on the physical conditions of the medium surrounding these organs, namely, the atmospheric air; and the discharge of water in these two ways has predominantly the effect of evaporation and consequently of cooling. Plentiful water-drinking does not exercise any *direct* influence on *perspiration*, which presupposes the existence of a very warm atmosphere. It is not directly sudorific in its effect, but it keeps up the diaphoresis produced by physical or other conditions, by the continued supply of material.

Another secretion which, according to the concurring experiences of Bidder and Schmidt, G. Lehmann, and others, is constantly increased by the plentiful use of water, is that of the *bile*; and here again a similar circumstance takes place as in the urinary secretion, as not merely the quantity of the bile but its solid constituents are absolutely increased. With regard also to the *saliva*, the *pancreatic juice*, and other secretions, similar observations have been made, and these, though isolated, correspond with the general and probable opinion that the secretions are altogether increased by the supply of water.

Increased secretion of bile.

Of great importance in the use of water is the *place where the water is absorbed*; this is the stomach and its veins. Water is, it is true, inhaled by the lungs from the atmospheric air, but this absorption is of minor consequence. The fact, however, that the water supplied to the body passes predominantly and primarily into the blood of the portal vein, is of great importance for the practical view of the subject. In the first place, it is in accordance with the general result of observation that the blood of

Absorption of water by the blood of the mesenteric vein.

the portal vein contains, under ordinary circumstances, the greatest amount of water; and next, it explains the experience that the effect of drinking cures, whether with simple or with mineral waters, is most frequent and most rapid in cases of disturbed portal circulation and imperfect formation of blood. If we take into consideration that the liver is probably the principal seat of the change of the blood-cells, and of their formation; that the water in the blood of the portal vein is found diminished more than half in the blood of the hepatic vein, and that the secretion of bile may be probably regarded as an incidental production from the blood-making function of the liver; lastly, that not merely the urinary discharge, but also the secretion of bile are considerably, and also in their solid constituents, increased by the plentiful use of water; we shall perceive the great importance, and the kind of importance, which belongs to the use of water, both as regards the change of substance and the formation of blood.

Effect of
water on
the
stomach.

The immediate effect of water on the stomach and on its functions is still but little*explained in detail. Its action on the digestion of food is principally through the supply of fluid for the formation of the digestive juices, as the gastric and pancreatic juices and the bile.

The necessity for the amount of water during and after meals, is regulated by the quantity and quality of food, and by individual habit; and we can only generally say, in accordance with daily experience, that when much meat is taken, the use of fluids, of course within a certain limit, promotes digestion. The absorption of the water itself takes place generally far more quickly in an empty than in a full stomach, and this justifies the usual time of day selected both for dietetic water-drinking, as a promoter of change of substance, and for courses of mineral waters, by which medicinal substances are to be conveyed into the juices.

Tempera-
ture of
drinking
water.

Among the special qualities of the water taken, we must first mention the *temperature*. All experience confirms the fact that water is all the more quickly absorbed by the veins of the stomach, the more its temperature

approaches that of the blood. As absorption is probably preceded by an equalisation of temperature, if the fluid taken do not approach the warmth of the blood, it is a question whether the requisite warming of cold water or the necessary cooling of warm water takes place more rapidly in the stomach. In general, the latter seems to be the case; yet the quantity of the fluid drunk has to be taken into account. The more cold or hot fluid is taken continuously, the slower must be the change of temperature; and experience teaches also that to deluge the stomach with water, whether cold or hot, equally retards absorption. *Cold* water acts upon the stomach as a local stimulant, just as on the outward skin, and as a reaction a more lively feeling of hunger is produced, and a greater readiness for absorption of drink and for the secretion of the gastric juice, if a meal be taken soon afterwards; yet the individual requirement is very different, and is limited, as regards cold water, to smaller quantities, which diminish in proportion with its lower temperature. After a night's rest, the stomach seems especially sensitive to the beneficial stimulus of cold water, and in the same manner there is no better carminative for many persons than a small draught of cold water a short time previously to a meal. That warm mineral waters, according to old established custom, are for the most part drunk at their natural temperature, is the result of accident, and this accident in no wise always harmonises with the therapeutic necessity; in many cases it is expedient to increase the warmth of the mineral water, and still more frequently to diminish it, and it is often highly advantageous to stimulate and prepare the stomach by a moderate draught of cold water before taking the first glass from a warm spring. One general principle alone can be given as regards the warmth of mineral water: the greater the quantity of the water taken within a short time, the more must its temperature approximate to the warmth of the blood, and individual circumstances alone can decide whether it should be above or below this.

From the misuse, both as to quantity and temperature, of waters taken medicinally, there result in many cases Well-fever.

various conditions of indisposition, differing according to the individual concerned, and most unsuitably comprised under the mystical common designation of *well-fever*. A well-fever does not exist, any more than does a well-spirit; and what is generally understood by the term are individual conditions, in consequence of a lasting or transient exaggerated effect produced by the method, diet, and new mode of life, often, of course, combined with excitement of the system, but without common, characteristic, and constant symptoms. Deluging the stomach with water very easily produces dyspepsia and catarrh of this organ; and the special peculiarities of the liquid, its cold or heat, and the different salts and gases contained in it, heighten and modify this influence; digestion suffers, nutrition fails, the skin is subject to various eruptions, especially boils, and from the general state of health the symptoms of the individual malady are increased. To this are frequently added, from the outward application of the water, especially if the sudorific plan be simultaneously used, various forms of sudamina, such as readily follows all perspiration, and particularly that of fever; and neither this nor the other symptoms merit the importance of crises, which play so great a part in Priessnitz's system.

Different
consti-
tuents of
drinking
water.

With regard to the *chemical constituents of common drinking water*, we confine ourselves to a few remarks. Distilled water alone is perfectly free from salts; rain-water approaches nearest, as also the water of melting ice, of brooks fed by rain-water, and of most streams; in all these waters the amount of salt rarely rises above 3 or 4 ten-thousandths, or 2 to 3 grains in 16 ounces. Among the common spring and well waters there are also many which do not contain more, whilst in most the amount of salt is between 6 and 15 ten-thousandths, or 4 to 11 grains in 16 ounces, and these principally consist of carbonate or sulphate of lime, sulphate of soda, sulphate of magnesia, and iron. As to the digestibility of drinking water in proportion to the amount of salt in it, *i.e.*, its various capabilities of absorption and its immediate effect on the stomach, there is a lack of accurate investigation; in

general, however, water most free from other ingredients, as rain-water, seems not sufficiently stimulating, and the sense of taste is in this respect probably the best guide. It condemns both the *softness* of river and rain water and the *hardness* of those spring waters which in their amount of salt approach the mineral springs, and is only satisfied with a moderate amount of salt. Besides softness and hardness, however, the sense of taste recognises the qualities of *purity* and *impurity*, and that of *freshness* and the *want of it*. The former is dependent on the deficiency or existence of organic products of decomposition, the latter on the existence of atmospheric air and especially of carbonic acid, which for the most part exists in greater quantity in well water than in rain and river water.

[It need scarcely be mentioned that we do not mean to say we can trust our sense of taste regarding the presence of subtle animal poisons, such as those of typhoid fever and cholera.]

From this sketch of the physiological effect of water as a beverage, its importance as a common agent in all spa cures, apart from the especial constitution of the mineral waters, is not difficult to estimate. The immediate effect on digestion, the general effect on the change of substance, and the lixiviation of the juices and tissues, are added to the other common influences of travel, change of physical and psychical mode of life, diet, enjoyment of fresh air, &c. In most courses of baths, likewise, an increased drinking of water appears as an incidental remedy, as with many such courses the drinking of waters is combined; and even when this is not the case, the whole mode of life encourages a more plentiful use of water. As regards a course of mineral water-drinking specially, the influence of the water alone can but rarely be critically distinguished from that of its characteristic constituents; yet there exist observations which confirm the general opinion, and afford indications for future successful investigations. An especially instructive example is afforded by the comparison of carbonate of soda and of waters containing soda, in their effect upon the secretion of uric acid. According to the observations already mentioned

Résumé
respecting
the use of
water as a
common
instrument
in balneo-
therapeut-
ic treat-
ment.

(page 64) the uric acid in the urine is often lessened considerably by plentiful water-drinking, frequently to its utter disappearance; the same effect is produced by mineral water containing soda; and that in this it is not the soda only that produces this effect, is proved by Münch's experiments,¹ according to which the carbonate of soda at first, indeed, diminishes the uric acid, until it almost wholly disappears; but this effect after some time ceases again, in spite of the continued use of the soda. In the use of natural soda waters, on the other hand, this effect not only continues as long as it is taken, but it often outlasts the course of treatment for some time; and thus it is clear that in this case, in addition to the specifically chemical effect of the medicinal substance, we have the general influence of the water-drinking upon the change of substance, as a powerful, and at any rate, equally important element in the cure.

Indications in favour of courses of water-drinking.

The indications in favour of internal water-cures with common water have been considerably limited within the course of the last twenty years, in spite of the fact that during that period the physiological effect of water has been more and more clearly perceived. The extreme length to which water-drinking has been carried in some water establishments, the experience that even pure water, taken in excess, may interfere with digestion, and the often repeated observation that in many states of chronic illness the object is obtained more rapidly, and without inconvenient effects, by mineral water containing salt and gas, and taken in smaller quantity; these experiences have greatly lessened the extent of water-cures with common water. On the other hand, the perception of the physiological effect of water has led to its more general dietetic use.

In fact, plentiful or regular water-drinking, even when combined with strict prescriptions, has for the most part only a dietetic importance; for example, as used in febrile diseases for the lessening of thirst, for cooling the blood, and for restoring its due amount of water; also in habitual sluggishness of the bowels, when a glass of cold

¹ *Archiv für Heilkunde*, vol. i. 1863.

water, taken fasting in the morning, stimulates the peristaltic action of the intestines; also in sluggish secretion of the bile, and in slight icterus, in which, however, in many cases, out of consideration for the stomach and the nutrition necessary, the preference is given to water containing carbonic acid; lastly, in all cases where it is desired to promote the change of substance, when this is retarded by the mode of life, especially where a plentiful meat diet is combined with physical inaction, and the lixiviating effect of water has, as it were, to take the place of bodily exercise.

As compared to this dietetic use of water, only a few special indications for regular courses have remained, viz., in metallic dyscrasia, syphilis, gout, and hæmorrhoids.

In *chronic metallic poisoning*, especially with antimony, arsenic, lead, copper, and mercury, there are two different ways in which the regular water-cure produces an effect. The metallic poisons are deposited partly in the different tissues and organs, partly and predominantly, and almost constantly, in the *liver*, in part as insoluble combinations. Their elimination takes place, in the first case through the perspiration and the urine, and in the latter through the bile; in the first case they are conveyed to the blood, and from this to the kidneys and the sudoriferous glands, and in the latter they pass away direct with the bile. In both cases, however, as they are for the most part insoluble, their elimination must be regarded as taking place less through their solution than through their mechanical removal with disintegrated cells; a view which presents no longer any difficulty at the present day, as most secretions are accompanied with the decay of old cells and the formation of new ones. For metals deposited in the liver, therefore, the effect of the water-cure mentioned at page 66 is desirable, as increasing the secretion of bile; for those deposited in the other organs and tissues, as causing a general increase of the change of substance. As, however, most cases of chronic metallic poisoning are accompanied by a greater or less degree of anæmia, in which not merely the coloured blood-cells, but even the fibrine of the intercellular fluid is

Metallic
poison-
ing.

Counter-
indica-
tions.

diminished, the water-cure is to be used with great care, in order not still further to injure the process of nutrition. In many cases of great anæmia it is either entirely to be condemned, or to be postponed until the nutrition has been improved by diet and the cautious use of iron, or a mild course of sulphur water.

Syphilis.

2. With regard to *syphilis*, few practitioners would, at present, treat *primary* cases by the hydrotherapeutic method; most medical men are also in *secondary* and *tertiary* cases more in favour of the commencement of the treatment by mercury and iodide of potassium, but use the water-cure as an after-course, or in cases with frequent relapses, when they fear to injure the constitution by the constant use of mercury and iodine. Only the milder hydrotherapeutic methods ought to be employed; the intention being to augment the tissue-change, and through this to increase absorption, and to eliminate the deposits of the specific dyscrasia. The plentiful internal use of water, and the promotion of perspiration by means of the wet sheet, appear to be the best methods for this purpose. The *atonic state of the skin*, which is so frequent a consequence of mercurial courses, and gives rise to constant chills, from changes of temperature and other slight causes, is especially benefited by the milder hydrotherapeutic methods. The well-known use of tisanes and the various decoctions of herbs, roots, and barks, owes probably much to the lixiviating effect of large quantities of water taken in this manner.

Atony of
the skin.

Gout.

3. Without entering at present into the theories on the pathology of *gout*, and the treatment based on it, and considering merely the influence which hydrotherapeutics, and especially water-drinking, can exercise, we must regard it as promoting lixiviation and increased change of substance, as shown by the increase of urea; and possibly we may have to take into account the increased secretion of bile. All that hydrotherapy has hitherto achieved in cases of *gout*, consists in improving the general condition and in dispersing gouty concretions in the joints. The treatment has, in addition to the internal use of water, had recourse to various forms of baths, but water-drinking formed an important element, no doubt;

above all, however, it must be observed that the successes generally have neither been more numerous nor more brilliant than in other ordinary courses of treatment, and that gout in most cases just as obstinately withstands hydrotherapy as it does all other heroic means. It is well known that in course of time, in proportion with the obstinacy of a disease, the number of remedies recommended and extolled rises, and gout is one of the conditions which has presented most abundant examples in this respect. One of the strangest methods is that of Cadet de Vaux (1825), according to which the sick person is to drink every quarter of an hour 6 or 8 ounces of hot water at 122° to 140° Fahr., till in twelve hours he has taken 9 or 10 quarts. Many persons have borne such violent treatment; in others the natural and immediate results, such as vomiting, great excitement, fever, and congestion of the brain, have risen to such a serious extent, that the treatment had to be discontinued; and several have even died from it. Successful results have been boasted of by the originator of the method, and by other credible authorities. Most of the cases mentioned, however, apparently do not belong to real gout, but to chronic rheumatism of the joints. Still it is always worth the trouble to repeat the experiment, though of course with prudent restriction.

Cadet de
Vaux.

[The *dietetic use of hot water* in gout has been, we believe, recommended by several practitioners, and we are ourselves in the habit of advising many gouty subjects to drink early in the morning one or two tumblers of hot water (at about 120 Fahr.), and, we think, in some instances at least, with good effect, viz., the disappearance of sediments of lithic acid and lithates in the urine, regulation of the bowels, and diminution of acute attacks of gout.]

A few brief remarks are here suitable upon *gravel* and the so-called *hemorrhoidal condition*, with reference to the use of water-drinking.

Although, according to Scherer's investigations, the formation of gravel is not caused by an excessive secretion of uric acid, but by the fermentation of the urine itself, yet the supposition is legitimate that a decrease of the uric acid secretion must produce a favourable effect, in so

Gravel.

far as it cuts off the supply of the real material for the formation of gravel. To this we may add the dilution of the urine, by which the mucous membrane is less irritated and more plentifully washed from the mucus producing the fermentation; and thus the good effects of plentiful water-drinking are easily to be explained. In spite of this, the drinking of common water has latterly been limited more to dietetic purposes, and has been supplanted in stricter courses by the use of acidulated soda waters, especially of the stronger kind, such as Vichy, Bilin, and others, because in most cases the carbonate of soda accelerates the effect and allows a smaller quantity of liquid to be taken, and because the stomach is supplied with a beneficial stimulant in carbonic acid, which common water lacks. If, indeed, important complications exist, as congestion of the liver, obesity, and such-like conditions, instead of weaker mineral waters and common water, preference is given to the complicated waters of Carlsbad, Marienbad, Tarasp, Franzensbad, and Elster, the efficacy of which has been frequently ascertained by experience; and even for dietetic purposes the acidulated waters deserve the preference, when regard for the stomach forbids the plentiful use of well-water.

Hemor-
rhoids.

The case is similar with *hemorrhoidal* conditions, which we shall have occasion subsequently to consider more particularly. Plainly as plentiful water-drinking is here indicated, especially as a means for the acceleration of change of substance, and deservedly as various forms of bathing are in repute, the practice of recent times here also limits water-drinking rather to a dietetic method, and, when a more energetic treatment is required, prefers mineral waters. Moreover, in the category of hemorrhoidal conditions we often find complications of the spleen and liver, from attention to which special indications are to be drawn. Even when it is desired to stimulate the secretion of bile, in spite of the confirmed influence of water-drinking upon this function, mineral waters and acidulated waters are more used than common water, because, in most cases, regard for the stomach, for complications, and for a more speedy result, obtains the preference for mineral waters and acidulated waters.

CHAPTER VI.

PRELIMINARY QUESTION AS TO THE EFFECT OF BATHS — ABSORPTION OF THE BATH WATER — MOISTURE, WEIGHT, AND TEMPERATURE OF THE WATER.

THE last of the common elements in most balneotherapeutic courses of treatment, is the *outward application of water*, as a bath, in its various forms and various degrees of heat. The elementary effects of this outward application are so important and so considerable, that, unless we understand them, our knowledge as to the manner in which mineral baths produce their effect would be very imperfect; and the opinions which prevailed previously to the beginning of the study of these elementary influences were, for the most part, devoid of all sure basis, and led, therefore, to all sorts of mystical and symbolical explanations. The points on which the requisite knowledge rests, are the effect of the weight of the water, of the moisture, and of the various temperatures, on the skin itself, on the general health, and on those functions which are intimately connected with the state of health, namely, on the formation and the radiation of heat, on respiration, on the contraction of the heart, on absorption and secretion, and on tissue-change. Whilst, as regards mineral baths, the amount of salts and gases has to be considered in addition to the above-mentioned points, the explanation of two of the most important kinds of baths is deduced wholly and entirely from those elementary influences; we refer to the *cold water system* and the use of the *indifferent thermal spas*; and both, therefore, may be suitably here discussed, and this with all the more benefit, as the range of their indications and the different mode of their effect comprises to a great extent the criticism

General
point of
view.

of all mineral baths. Hydrotherapy and the knowledge of tepid baths, while they are the direct result of the elementary study of the effect of water, also form the foundation of the entire doctrine of mineral baths; and as it required a long time before the simple method of hydrotherapy prevailed over the complicated method of prescribing drugs, and before the idea of tepid baths displaced the assertion of an unknown and mysterious agent, so it is only since both of these have triumphed, *i.e.*, since the influence of cold and warm water has been recognised in its elementary effects, that rational methods of balneology have been arrived at. All discussions on the subject, however, must be preceded by the question of the *absorption of water* and its constituent parts through the skin, a question which was considered indisputable until twenty years ago, and the negative reply to which in recent times has called forth a lively controversy.

Absorption of water through the skin.

1. *Absorption of Water through the Skin.*—For a long time, as we have said, it was accepted as a matter of course that water with its constituent parts penetrated the skin in bathing and passed direct into the blood; and by this a great part of the effect of baths was explained, and especially the specific differences existing in them. All the less reason was felt for doubting a fact so universally accepted, as the perviousness of the skin with regard to various matters presented to it in the form of ointments and plasters, was indubitably shewn by daily experience; and it was in no wise any doubt of the absorption which caused the first accurate investigations, but only the desire to be acquainted with the design, manner, and measure of this undisputed function. The first experiments (by Abernethy, Collard de Martigny, Lebküchner, Krause, Gerlach) related to the *absorption of gases*, and these were attended with an affirmative result, as both the measurement of the gas left behind, and the deleterious effects of that absorbed, were ascertained by the simple method of investigation followed. Also sulphuric ether, oil of turpentine, and the acrid ingredients of vesicants penetrate the epidermis, though not without an apparent chemical change in the structure of the skin. Both the

latter substances, and also the gases, penetrate not merely the epidermis connected with the living skin, but also the isolated epidermis; that, however, permeability of this substance is the indispensable and sole condition for the assumption of absorption, was known from the first, and was proved by the ready absorption at places where the outer skin was removed. Krause operated with other substances; for instance, with common salt, sulphate of copper, nitrate of potash, cyanide of potassium, ferrocyanide of potassium, chloride of iron, chromate of potash, acetate of lead, sugar, gum, and white of egg;¹ and found that the aqueous solutions of these substances, even after the lapse of several days, failed to penetrate the isolated epidemis, although this was the case with more concentrated solutions of acids, alkalies, and nitrate of silver. Krause, however, still maintained the doctrine of the permeability of the epidermis for all solutions, because he placed more confidence than was due in experiments.

Wetzler, Falconer, Young, Kathlor, Madden, Berthold, and others had endeavoured, by weighing the body before and after bathing, to ascertain the amount of water absorbed; in so doing, some found an increase of weight up to several pounds, and others, and indeed the greater number, to several ounces, and credence was readily and universally given to these observations, because the absorption of concentrated solutions and substances applied in the shape of ointments had been long proved, and, moreover, because in and after the bath a considerable increase of diuresis was often observed, which was explained by the direct reception of water.

Earlier
weighing
experiments.

Very important objections, however, speak against the validity of these weighing experiments. In the first place, the difficulty arises of perfectly drying the epidermis after the bath, covered as it is with hygroscopic hairs, and furrowed with countless capillary channels, and of effecting this within so short a time, that the constant loss of weight, through the perspiration of the skin and lungs, may not have exerted any essential influence. In the

Objections
against the
weighing
experiments.

¹ See article 'Skin,' in Wagner's *Handwörterbuch der Physiologie*, 1844.

second place, this normal loss of weight by perspiration, varying as it does in different persons and at different times, has to be taken into account, and this can only be determined before and after the bath, and not during its continuance; and in these earlier experiments it had, moreover, been ignored. In the third place, no scales have been invented which are free from errors of grammes and ounces when weighing bodies as heavy as a man; and this difficulty is increased four and five-fold if the attempt be made to weigh the bath-water before and after the bath, as this involves an amount of water of 500 to 600 pounds. Lastly, the fact of the absorption of concentrated substances is of no importance, because these destroy the structure of the epidermis by chemical decomposition; and in the rubbing in of ointments the same consideration has to be taken into account, besides the supposition that the rubbing may also change the mechanical structure of the epidermis.

More recent experiments.

These considerations caused a number of investigators, among whom we may mention Kletzinski and L. Lehmann in Germany, Hébert in France, and Thomson in England, to repeat the experiments of weighing bodies with a previous and subsequent estimate of the amount of perspiration and of the loss of weight arising from it, and to combine with these experiments others relating to the absorption of such substances as, when they are received into the blood, quickly appear again in the urine. The first class of these new experiments produced a result opposed to the former ones: not an increase, but a *decrease of the weight of the body* takes place in the bath, either because substances are given off by the skin into the bath-water, or because of an increase of the expiration from the lungs. As, however, the amount of this decrease falls within the limits which comprise the variable loss of weight through perspiration, the non-occurrence of absorption by the skin is in no wise proved by this result; it is only shown that this, if it do take place, can only extend to small quantities.

The second mode of investigation has unfortunately not produced corresponding results. Kletzinski and others have in vain sought in the urine for substances added to

the bath; for example, for ferrocyanide of potassium, iodide of potassium, &c. Others, such as Villemin,¹ have found iodide of potassium in the urine; and in recent times Clemens has reported positive results by means of local baths in a solution of common salt. The objection has been raised against such positive results that either injured parts of the skin, devoid of epidermis, may have rendered absorption possible, or that the substances referred to may have been retained in the furrows of the epidermis. Although these objections may not be altogether without foundation, they cannot after all decide the question; and all the less so, as the anatomical structure of the skin in no wise excludes the possibility of absorption, which is proved in the capillary absorption by the millions of perspiratory pores.

After all, the question of *absorption* remains an open one, and the one fact alone seems to be satisfactorily proved, that absorption, if it do take place in the bath, can only be small in amount. Should subsequent experiments place the general fact beyond doubt, it still remains to be investigated whether the absorption of a small quantity of salts introduced directly into the circulation of the blood, produces as powerful an effect as greater quantities received from the stomach. Experiments as to the direct injection of alkaloids, tartar emetic, and the like, seem at any rate to speak in favour of such a possibility; but until this is ascertained with regard to the far milder constituents of mineral baths, we have no right to reckon upon the absorption of the skin in aid of the theory of the effect of baths. It is enough that for the present the absorption of gases is an established fact, and that, as will subsequently be shown in discussing the waters that contain common salt, the effect of this cannot be mechanically explained. In general, however, a very cogent reason speaks against the absorption of considerable quantities of salts; if this did occur, what deleterious effects upon the blood must inevitably appear!

Résumé.

¹ 'Recherches Expérimentales sur l'Absorption de l'Eau,' *Gazette des Hôpitaux*, 1863.

Purifying
effects of
water.

2. *The Moisture of Water a Means of Cleaning the Skin.*

—This effect of water, important as it is, scarcely requires an explanation, and need only be mentioned, as the circumstances it involves lie clearly before us. The main object of hygienic ablutions and baths, is the purification of the skin from the deposits which are left behind as the residue of the cutaneous secretions and of the shedding of the epidermis. It is evident that frequent purification of the skin from this crust must favour perspiration; and the different necessity for purification, according to the different modes of life and different conditions, thoroughly corresponds with this view. The more vigorous are a man's physical movements, the less need has he of ablutions for the maintenance of his health, partly because with physical activity the vicarious exhalation of the lungs increases, and partly because the continual friction of most parts of the skin, and the perspiration produced by work, are sufficient in themselves to perform the mechanical task of cleaning. Thus experience teaches that to the labourer baths and ablutions are less necessary than to the man of a sedentary mode of life, and to the infant, whose lungs discharge their office feebly, far more than to the adult; and in the same way the good influence of lukewarm baths upon the health of consumptive patients is perhaps principally to be ascribed to the promotion of vicarious perspiration by the skin. Poor in solid matter as are the secretions of the skin and perspiratory glands, and averse as the opinion of the present day is to the theory of the retention of deleterious matter, equally little can we overlook the daily experience as to the dangerous effect of suppression of the function of the skin, as well as the experimental observation that animals, whose skin we cover with an air-proof layer of varnish, speedily perish from hyperæmia of the lungs, after their temperature has fallen—the latter being a proof that the cause of death is not the impeded radiation of heat. In connection with this point we may draw attention to the résumé of G. Lehmann,

‘One of the undoubted uses, although not the principal object, of the cutaneous transpiration, is to regulate the

temperature of the animal body.' . . . 'It is generally believed that the transpiration is the medium through which certain substances are eliminated, the retention of which would give rise to various morbid conditions. The unprejudiced observer cannot fail to acknowledge the injurious consequences that follow even a partial suppression of transpiration, and yet the imperfect analysis of the chemical constituents of the cutaneous secretion not only fails to give us an explanation, but it might even lead to the erroneous view that these functions of the skin might be perfectly replaced by the kidneys, for a portion of the constituents of the perspiration are contained in the urine. We should, however, draw a hasty conclusion if we were to attribute, from the investigations of chemists, less importance to cutaneous perspiration. Although we can refer individual groups of symptoms to affections of the peripheric nerves directly produced by the rapid cooling of the surface, the complex of sequelæ must induce us to think of the retention of certain deleterious substances. In the imperfect state of zoo-chemical analysis with regard to the volatile odorous matters, we may suppose that these odorous substances, always present in the perspiration to a greater or lesser amount, induce definite changes in the metamorphosis of the blood as well as in the functions of different organs, and through this occasion various morbid conditions connected with chill. We may remind that many volatile substances belonging to the *materia medica* and toxicology, when introduced into the blood or other juices of the body, even in minute quantities, cause the most urgent morbid phenomena.'¹

3. *The Weight of Water.*—This property is only taken into consideration for the sake of completeness, and inasmuch as from its immediate effect the feeling of oppressed muscular action and respiration may be explained, which is constantly manifested at the beginning of a bath. Although the amount of this pressure is very considerable,

Weight of
water.

¹ Professor C. G. Lehmann's *Physiological Chemistry*, 2nd Edit. vol. ii. p. 339.

it exercises, like the variations in the atmospheric pressure, only a slightly perceptible direct effect, which hitherto has not been shown in the general decrease in volume of limbs cylindrically formed, but only in the feeling of oppression of the breath, a feeling which passes away in most people after a few seconds or minutes. This dyspnoea is, moreover, not always the consequence of pressure, but very often is the effect of cold. All that is otherwise added to the effect of the bath by the hydrostatic pressure, relates to the skin and the soft parts lying beneath it, and accessible to external mechanical influence. The depletion of the capillary vessels, which occurs at the beginning of the bath, and of which we shall presently speak, is at any rate promoted and accelerated by the weight of water; and if energetic movement of the parts of the body in the water, their rubbing and kneading, or the application of a jet of water be added, this mechanical influence will of course be proportionally strengthened.

Thermo-
logical
literature.

4. *Temperature of Water.*—*Theory and Facts respecting the Conditions of Animal Heat.*—The advances made in the physical theory of heat, as well as the thermometrical and hydrotherapeutic treatment of fevers, the one having already arrived at a theoretic conclusion, the other, although only at the opening stage of its experimental and theoretic investigations, affording nevertheless already practical results, have at last opened a field of facts and views which cast a clearer and more scientific light than any we have hitherto known, on the doctrine of the effect and application of baths.

The theory of physical and organic heat, and the literature respecting the thermometrical treatment of fevers, is accessible to all through excellent works, many of them written in a most acceptable popular form; and no medical library should lack all that Bartels, Jürgensen, Wunderlich, Küchenmeister, Liebermeister, and Tyndall have written on the matter. For our present subject, which has nothing to do with acute fevers, but with chronic illnesses, we must presuppose the knowledge of those writings, and must content ourselves with stating in aphoristic succession the little which can for the present

be turned to account with regard to the application of hydrotherapy to chronic morbid conditions. At any rate, no physician who intends thoughtfully to carry out a hydrotherapeutic course of treatment in an acute or chronic case, ought to have left unread the historical monograph of Küchenmeister, and the clinical lectures of Liebermeister, and Tyndall's 'Heat,' books which, from their popular form, demand but little expenditure of time and attention. Only thus will the following aphorisms, with which, as carefully and critically selected matter, we preface our doctrine of hydrotherapeutics, be intelligible, and practically as well as theoretically useful.

1. The temperature of *plants*, and of the *lower (cold-blooded) animals* is, with slight deviations, that of the surrounding media, while the *higher animals—birds, mammals, and man*—possess a heat of their own, which is only transiently modified by the heat of the surrounding media, but on the whole is maintained at a fixed standard. This heat is called *natural heat*. Absolute heat.

2. The principal vehicle, though not the only source of the heat of the body, is the *blood*; while the tissues freeze at 32° Fahr., the blood only freezes at 26·6° Fahr., and while the tissues lose their warmth almost as quickly as water, the blood resists even strong and lasting refrigeration. Blood.

3. *The sources of the formation of heat* we must seek, in order not to be led astray by hypotheses, only in physical forces, in the chemical combustion of organic matter (but not, as was for a long time the case, merely of the carbohydrates, but of albuminous substances), in muscular action, and in the motion of myriads of blood-cells, thus altogether, like cosmical heat, in molecular motion. As in the steam-engine and in the friction and fall of bodies, so also in the physical organism, heat is converted into motion and motion into heat. If, therefore, we indicate organic functions as producing heat, we must regard these only as motion, and we cannot ascribe to innervation an immediate influence upon the production and regulation of heat, but only an influence brought about by motion. The nerve-centres, too, exercise their in- Sources of heat.

fluence on animal heat only by their action on *molecular motion*, viz., on the interchange of substance in cells and intercellular fluid, therefore on chemical conditions. A physical moment hitherto not taken into account is the latency and reappearance of heat, which no doubt occurs in the organism as well as out of it.

Loss of
heat.

4. Constant formation of heat is not conceivable without an equally *constant loss of heat*; and this is effected in a purely physical manner by those organs which come into contact with the atmosphere and the coverings of the body, namely, the mucous membrane of the mouth and the respiratory organs, and especially the external skin.

General
conditions
of absolute
heat.

5. *The heat of the body results, therefore, from the formation of heat and from the loss of heat*; and as, under normal circumstances, it remains always the same, we can well assert with Liebermeister that *exactly as much heat is formed as is withdrawn*, that a plus of loss of heat is covered by a plus of formation of heat, and a minus of the one by a minus of the other.

Conditions
of loss of
heat.

6. The constant heat of the body is not only, when influenced externally, preserved by increased or diminished production of heat, but also by *conscious, instinctive, and organic arrangements*, which increase or diminish the loss of heat. The former relate to the covering of the skin, to the amount of exercise, to drink and food; the latter, however, disclose a physical proceeding with its necessary consequences, for, by the increased refrigeration of the skin itself, further refrigeration is limited. To this is added the physiological element of the diminished supply of heat to the skin, consequent on contraction of the superficial vessels, which lessens the flow of blood to the skin. Whilst here the loss of heat is moderated by physical and organic conditions, the contrary, namely, the increase of the loss of heat, is facilitated by similar conditions; for with increased heat of the body the blood flows in greater quantity to the enlarged capillaries of the skin, and a more rapid radiation of heat and evaporation of water takes place, and in a great increase of heat the evaporation of perspiration forms a powerful means of refrigeration.

7. In the cold and in the temperate zones the temperature of the atmosphere rarely reaches that of the blood, but generally remains far below it, and life and health can exist at a difference of 144° Fahr. between the temperature of the air and that of the blood. Even in the torrid zone the air is far cooler than the blood, and the change of the different parts of the day affords sufficient opportunity for cooling. With this climatic condition the physical and physiological functions of the regulation of heat correspond, and in general, under normal conditions of life, the *regulation of heat is predominantly brought about by the loss of heat.*

Preponderance of loss of heat.

8. The reverse side of this state of things would be the *decrease of the production of warmth* under external conditions which greatly impede or entirely prevent the loss of heat, or which even expose the body to a positive increase of heat proceeding from without. This decrease of production no doubt occurs, but we do not possess, as yet, observations stating the exact degree of diminution, and on the other hand we find that the highest degrees of heat give rise to enormous perspiration, and thus to loss of heat by evaporation. Experience proves that man can endure a temperature of 194° to 212° Fahr., presupposing that the air is dry and thus favours evaporation to the utmost extent; and the labourers at the Suez Canal have been able to sustain the rays of the burning sun at a temperature of perhaps 122° Fahr., while they were plentifully supplied with water, enabling them to keep up a constant perspiration.

Regulated decrease of the production of heat.

9. If thus, for the regulation of heat generally, *greater importance* is to be ascribed to the *loss of heat* and the conditions existing for effecting this, we find also much more frequently the occurrence of *increased production* of heat, in order to counterbalance increased loss of heat, than diminished production of heat with diminished loss of heat; and clinical experience shows that an increase of body-heat amounting to 9° or 11° Fahr. is fatal, while the fatal minus appears to be about 16° Fahr.

Preponderance of increased production of heat.

10. *Abnormal increase of heat in the blood*, as such, is fatal, owing to parenchymatous degeneration of the

Consequences of an ex-

tremely high or low amount of absolute heat.

organs, especially of the brain and heart, and *abnormal decrease of heat of the blood* produces a similar effect by stagnation in the veins in consequence of a diminished flow through the arteries, thus causing a deficient decarbonisation of the blood. The degeneration of the organs is probably the physical effect of heat, while death from abnormal decrease assumes a similar character as in carbonic oxide poisoning.

Combustion and motion.

11. The organic production of heat has two different sources, which, for the sake of theory and practice, must be kept thoroughly distinct, namely, *combustion and motion*.

Combustion, constantly maintained by respiration, is the *constant source of heat* in the passive body, and depends, therefore, on the oxidation of organic matter.

In addition to this permanent source of heat, there is occasionally and temporarily a second, namely, *muscular action*, which also is essentially chemical, in so far as the active muscular substance is oxidised; the warmth produced by this, however, is partly lost to the body, because by motion the heat is changed into mechanical power and thus disappears.

Permanent chemical production of heat.

12. *The production of heat, which is necessary for the regulation of heat and the maintenance of constant heat, is effected without any considerable expenditure of organic power and organic functions.*

Accessory production of heat by motion.

13. The increased production of heat derived from muscular action possesses, therefore, only a *casual and accessory importance*, but has no essentially necessary relation to the maintenance of constant heat; its amount is, moreover, small, and even imperceptibly so when compared with the increase of heat arising from disease.

Production of heat by the stimulus of cold.

14. Among the causes which increase the production of warmth, may be mentioned *the stimulus of cold*, especially of a sudden, violent, and passing cold;¹ and this effect appears without any increase of muscular action, and is therefore exclusively to be referred to the chemical source of heat belonging to the oxidation of organic matter. By the stimulation of cold, therefore, a function,

¹ See No. 12, *g* and *h*, page 90.

whether peripheric or central, is excited, which increases the oxidation in the blood and tissues; and as this is effected without increased action of voluntary or involuntary muscles, we can conceive this process only as an effect of *innervation* upon the blood and tissues. An innervation, however, which we do not find expressed in muscular contraction, in sensation, or in secretion, but only in a direct chemical process, we could scarcely look for elsewhere than in electric currents, which, moreover, form the only physically measurable function of the nervous fibres.

15. *Fever-heat* also appears without increased muscular action, and it frequently reaches its extreme height while the body is compelled to rest. It also can, accordingly, only be referred to the permanent and chemical source of heat effected by oxidation, and to that action of the nerves which increases the temperature under the stimulation of cold. Whilst, however, in that case the effect of the stimulus of cold is transmitted from the skin to the nerves, in fever the cause of the change seems to lie in the blood itself; and this is all the more probable, as a poisoning of the blood is generally proved to be the essential cause of the fever, especially of those fevers which must be regarded as diseases arising from infection.

Fever-
heat.

16. If a healthy body maintain its constant or absolute heat against all outward influences at an average of 98.6° Fahr., and if the feverish organism present a degree of heat of more than 98.6° —for example, of 104° Fahr.—so that, after all abstraction of heat, it constantly returns to the same degree; we can only agree with Liebermeister's theory, according to which *absolute heat* (no longer, as hitherto, regarded as a physical condition, but as a physiological function) consists in this, *that the body regulates its temperature at a fixed degree*, the healthy body on an average at 98.6° Fahr., and the feverish one at a higher degree, almost constant, however, in each individual case.

Symbol of
the regu-
lation of
heat.

17. The above-mentioned *nervous source of absolute heat*, which we must necessarily infer to the exclusion of other possibilities, is more clearly brought before us, as well by the well-known experiments performed by Tscheschechin

Nervous
centre of
permanent
heat.

and by Naunyn and Quincke on the medulla oblongata and the cervical and upper dorsal portion of the spinal marrow, as also by numerous pathological observations communicated by Brodie, Billroth, Hermann Weber, Hutchinson, Nieden, and others. Both, *i.e.*, experiment and pathological observation, show that the regulation of animal temperature is dependent on the nerve-centres.

The existence of an excito-caloric or of a moderating system rests for the present upon conjecture; very probably both exist, to judge from the analogy of automatic movements of the heart, the organs of respiration, and the muscles of the intestines. In the increase of heat as the immediate consequence of the stimulant of cold, as, for example, of a cold bath, an excito-caloric system seems alone to prevail, as in this case all the symptoms assume the form of irritation; and, moreover, the frequently enormous increase of carbonic acid excretion indicates a direct increase of the production of heat. On the other side, in pyrexia, symptoms are observed which urge upon us the assumption of a moderator system.

Quantitative differences of absolute heat or heat of body.

18. The *differences observed* in the normal as well as in the abnormally altered heat of body, amounting to a few degrees and to small fractions of a degree, have a far greater arithmetical value than appears to result from their absolute proportion to the Celsius or Fahrenheit scales. They are not to be placed in comparison with the high average figure of 98.6° Fahr., but with those numbers, between which the possible and the observed elevation or depression of the temperature is fixed. The highest increase of temperature which the human organism can endure, is about 9° Fahr., the greatest depression of temperature about 14.4° Fahr.; in both directions, 3.6° Fahr. are felt of great importance, as they mark the limits of the normal condition, and thus changes of temperature of a few degrees and parts of a degree, are very important changes; and this importance is intelligible when we reflect what a great production of heat is necessary in order to heat the whole mass of blood 0.1° Cent., or 0.18° Fahr.

Changes of

19. Within these narrow limits of the normal heat of

body, a few *differences* are observed which relate to certain conditions; as yet, however, their number is very small, and further detail will only result from very extensive observations, as it is to be assumed *à priori* that everything which produces an effect on the organism must be able to change the production of heat. The following observations have been made.

a. There is a *daily variation* of the amount of natural heat; it increases at 6 o'clock in the morning, and reaches its maximum between 10 and 12 o'clock; in the afternoon it falls again, and reaches its lowest point at 2 o'clock in the morning; between 10 o'clock in the morning and 5 o'clock in the evening the variation is smallest, and between 7 and 9 o'clock in the evening it is greatest. In children this daily variation is greater than in adults, often amounting in them to more than 3.6° Fahr.; in the latter to less.

b. Natural heat is greater in *physical activity* and in the *waking* state, and less in *repose* and *sleep*.

c. *Children* and *old people* have a higher heat of body.

d. Many weak people have a *higher* heat of body, and others, especially those suffering from anæmia, a lower; sudden loss of *blood* and animal juices lessens the temperature, and this appears most strikingly after intestinal bleeding in typhoid fever.

e. The condition of *menstruation* is also stated to be attended with a diminished temperature.

f. *Certain substances* introduced into the blood considerably depress the temperature, very probably owing to the intervention of the nerves; namely, alcohol, veratria, digitaline, quinine, aperients, and emetics.

g. An *extreme loss of heat* through external refrigeration of the skin increases at first the production of heat, but only transitorily; the final result is a depression of temperature.

h. Whilst refrigeration of the skin at first increases the production of heat, this is not the case with *cold beverages*; these cool to some extent without temporarily increasing the temperature.

i. *Drink* does not cool merely on account of its cold-

ness, but also on account of its nature as a fluid, probably by increasing the tension of the blood; this may be inferred from the fact, that in Schroth's course of treatment an injurious increase of temperature to 104° Fahr. has been frequently observed.

Increased
carbonic
acid secre-
tion.

20. With increased production of heat there is always combined an increase of *carbonic acid excretion*, and this to the greatest extent, 300–500 per cent., in cold baths, and to the smallest extent in fevers of high temperature, such as typhoid—a further illustration of the active character of the production of heat after cold baths.

Emphy-
sema in
typhoid
fever.

21. The fact that *emphysema* prevents a very great increase of temperature in typhoid fever, renders it probable that impeded decarbonisation of the blood interferes just as much with the production of heat as the latter itself is favourable to the former.

Pulse and
natural
heat.

22. In general, by an increased temperature of the blood, the *pulse* is accelerated, and it is retarded by a lower temperature; with a very high temperature the muscle of the heart is paralysed, and with a very low one, the centrifugal innervation is depressed through deficient decarbonisation of the blood.

Sensibility
to heat
and cold.

23. *Perception of the different degrees of heat* through the nerves of the skin and the sensitive nerves of the mucous membrane is to a certain extent independent of the absolute degree of the external temperature, in so far as it essentially depends upon the impression made on the sensitive terminations of the nerves by the greater or lesser rapidity of the giving off of heat.

Medium
tempera-
ture of
air.

Apart from individual conditions, therefore, and under normal circumstances, the perception of heat of a man in repose is dependent on the temperature of the surrounding air; and there must be an atmospheric temperature in which this perception of heat may be called neutral, and does not reach consciousness. This *medium* or *indifferent temperature* lies between about 72° and 77° Fahr. in the temperate zone for the healthy unclothed man in repose; at this temperature, if the air be not too moist, the expenditure of heat takes place according to a certain measure of time corresponding with the undis-

turbed state of the organism and the average condition of the sensitive nerves; a cooler temperature of the air accelerates this measure, and causes a sense of cold; a higher temperature retards it, and produces a feeling of heat; and in both cases instinctive or organic functions intervene, in order either to diminish or to increase the expenditure of heat.

The case is, however, different with the effect of water as a vehicle of temperature. In a temperature which makes the air an indifferent medium as regards the feeling of the skin, water produces a cooling effect, and a bath of 77° Fahr. or 25° Cent. may be considered a cold bath for most people, because water is a far better conductor of heat than air; and on the other hand, a warmer bath is felt much more sensibly than air of the same degree of temperature, especially as in the bath the evaporation of perspiration ceases, and this in hot air has a cooling influence. The temperature at which a water-bath corresponds with a medium air-bath is between 87.8° and 98.5° Fahr., or 31 and 37° Cent., and at this temperature the process of the giving off of heat produces the same medium and neutral effect on the feeling as in an air-bath of about 72 to 77° Fahr. Nevertheless, this medium bath temperature deserves this denomination only in a limited sense; it can only be so called with regard to *feeling*, and not with regard to its *effect*; and even the general perception is for the most part not unaffected in the bath, in so far as a sudden sense of general comfort, a sense between calmness and excitement, is wont to come on, and this, as we shall presently show, is connected with the essential effect of a medium or indifferent bath.

Medium
tempera-
ture of
baths.

The above aphorisms point out the material from which, in the two following chapters, with the aid of clinical experience, we shall deduce the effects of the cold and the warm bath.

CHAPTER VII.

THERAPEUTIC USE OF COLD—DEVELOPMENT OF HYDROTHERAPY—COLD WATER ESTABLISHMENTS.

IN the antipyretic treatment of typhoid fever, Currie not only employed cold water baths in various forms, but also cool air baths applied to the naked body, and this with considerable and thermometrically measured results. This method of treatment has not been subsequently tried, and justly so, because it cannot be accurately adapted, and various external difficulties also arise. At present we use water exclusively for general refrigeration, and ice and the evaporation of ether are employed for local cooling. The means of hydrotherapy is the water-bath in its various forms.

A. ELEMENTARY EFFECTS OF THE COLD BATH.

- a. *Experiments on Animals with the entire Body, and with separate Parts of the Body, visible to the Eye, and transparent.*

Experiments on animals.

The immediate effect of extreme cold in experiments on animals is of course modified by the individual and external conditions of the subject of the experiment. In general the following results are witnessed: 1. Contraction of the vessels of the skin, in consequence of the increased activity of the sensitive and motor nerves of the blood-vessels under the stimulus of cold. 2. Diminished supply of blood to the arteries, and consequent retarded flow in the veins. 3. The sensitive nerves of the skin are at first stimulated, and under prolonged influence are placed in an anæsthetic condition, which, however, passes over, and this without trophical change of the nervous substance. 4. Through prolonged application the

texture of the muscular substance suffers from the disintegration of the elements of the primary fascicles. 5. The decrease of the temperature of the blood in an animal having a normal heat of 91.4° Fahr. (33° Cent.), amounts in the first few hours to 3.6° to 5.4° Fahr. The temperature subsequently may sink to 77° Fahr. and much lower, but a reduction to 75.2° Fahr. is in this case absolutely fatal. 6. The cause of death lies in the deficient decarbonisation of the blood, and is produced partly directly through the decrease of temperature, and partly and predominantly through an accumulation of blood in the veins of the systemic circulation, and through anæmia in the pulmonary circulation, just as in a high degree of pulmonary emphysema, and as in this, death ensues with the phenomena of cyanosis. 7. In the capillary current, oscillations of the blood-corpuscles appear, which are at first distinct and rapid, and gradually become slower until movement wholly ceases; similar rhythmical contractions may be observed in the arteries beyond the capillaries; these, at any rate, are dependent on the nerves, and appear not only under the stimulant of cold, but under every other stimulating cause.

b. Condition of Man in the Cold Bath.

1. *Temperature.*—In the cold bath an actual lowering of the temperature of the skin takes place, amounting in extreme and fatal cases to 9° and 18° Fahr., and up to 9° Fahr. within the limits of endurance. At the same time, however, the temperature of the blood increases from 1.8° to 3.6° Fahr. according to the violence and suddenness of the refrigeration, but in no wise in proportion to its duration; on the contrary, by prolonging the bath, the heat of the blood sinks with the temperature of the skin, and at the termination of the bath the former remains somewhat diminished, even though the skin may have recovered its warmth. The cold bath, therefore, is attended with an increase at first of the heat of the blood, but with a subsequent lowering of its temperature. This,

Elementary effect in man—Temperature.

however, both under normal and abnormal circumstances, is speedily equalised again, frequently in a few minutes, and sometimes in some hours.

Carbonic
acid se-
cretion.

2. The *secretion of carbonic acid* is increased in the cold bath, so long as the internal increase of temperature lasts, and this very considerably, often 300 to 500 per cent., and all the more the more rapidly the temperature of the blood rises. It is evident that this phenomenon is in direct connection with the increased production of heat. And further, it is probable that this increased combustion is predominantly in relation to the non-azotised substances, because in acute fevers, especially in typhus, the increase of the carbonic acid secretion is very slight, and this in exact proportion to the height of the temperature, whilst the products of the change of substance exhibit a far greater consumption of azotised matter.

Pulse.

3. The *pulse*, as well as the *respiration*, is at first somewhat quickened; it soon, however, becomes slower, and the latter grows deeper.

Sensi-
bility.

4. *Sensibility* is at first increased, and this expresses itself in the feeling of shivering and chilliness, and in increased sensitiveness to external irritation; this is succeeded, if the bath be continued, by a conscious feeling of numbness and actual anaesthesia. As soon, however, as, after removal from the bath, the temperature of the skin is restored, sensibility returns, and is sometimes heightened.

Skin.

5. The *skin* loses its turgor, the cutaneous muscular fibres contract suddenly and quickly; hence the appearance of the so-called goose-skin; the smaller vessels also contract; and all these phenomena adjust themselves again after the cessation of the bath. From this we may infer with great probability that the minute processes of circulation in man are analogous to those just mentioned as occurring in experiments on animals.

Internal
organs.

6. *Effect upon Internal Organs.*—At first there appears a certain excitement of the nervous system, which is especially manifest in the spinal marrow, as shewn in the trembling of the limbs. This excitement soon, however, passes into lassitude, the muscles become for the time half paralysed, and a general weariness takes possession of the

whole frame. The change of pulse has been mentioned above, under No. 3. Hyperæmia of the lungs, which is so constantly feared from mechanical considerations, is but rarely observed; cerebral apoplexy likewise rarely appears, though attacks of illness and death have been observed which assume the form of a shock.

7. *After the completion of the bath*, a more or less evident change occurs in all the phenomena opposite to the primary effect. The feeling of cold ceases, and is succeeded by an increased feeling of heat, especially at first, so long as the production of heat which has been increased by the stimulant of cold lasts, and until the generally cooling result of the bath asserts itself. The sense of touch is restored, and often becomes more acute than before the bath; the contraction of the muscular fibres of the skin is succeeded by relaxation, the anæmia of the capillaries by some degree of capillary congestion, while the hyperæmia of the superficial veins disappears; respiration becomes easy; a sense of freshness, elasticity, and strength makes itself felt throughout the muscular system; the sensorium becomes clear, and the whole psychical condition shares in the general refreshment.

Consequences of the cold bath.

c. General Character of the Effect of the Cold Bath.

In each of the above-mentioned phenomena a contrast asserts itself between the beginning and the subsequent condition. The phenomena of the latter are the expression of an organic activity, and as this follows directly upon a preceding opposite condition, we may designate it as *reaction*, a physiological reaction against the stimulant of cold. Besides this reaction, however, there is a second constant effect of the cold bath, namely, a cooling of the temperature of the body at various degrees and duration; this is to be explained altogether physically, as the simple result of increased loss of heat; and the amount of this loss is greater than is shown by the degree of the diminution, as this is rendered less apparent through the increased production of heat, one of the primary effects of the cold bath.

Reaction.

See also
the use of
heat.

We must here especially draw attention to the importance of the skin in the loss of heat externally. It is the skin principally which is the medium of the constantly necessary loss of heat, and this by means of its organic structure and the functions belonging to it. The part, however, which is assigned to it in this respect is by no means one-sided, and does not consist in merely promoting, but also in moderating the radiation of heat, a fact which is rendered manifest by well-known experience in burns of the skin. In extensive burns the temperature of the blood falls much and rapidly, even in a warm atmosphere, in human beings to 91.4 Fahr.; a fact which cannot be explained by chemical conditions, but only by the greatly increased refrigeration of the blood, in consequence of the distended vessels being deprived of their protecting and moderating covering.

Physio-
logical
value of
reaction.

d. *The physiological value and character of the reaction after the cold bath* consist in general in the stimulation and heightening of most of the organic functions, preceded by a very transitory depression; the sensory and motor nerves, the muscular system, the heart, and the skin, form the basis both of the excitement and of the reaction; but the increased production of heat, together with the increased elimination of carbonic acid, and therefore the increased combustion of organic matter, are the combined expression of the sum of these different reactions.

Thus, then, the exact character of the physiological effect of the cold bath may be expressed by saying that the skin, stimulated by the cold, increases most of the vital functions, and that, nevertheless, the temperature of the blood is subsequently depressed; that therefore *stimulation* and *refrigeration* are produced.

General
alterna-
tion of the
cold
water
treatment.

e. In accordance with these two different effects, excitement and refrigeration, the treatment of the cold water system is divided into two essentially different branches, according to that effect which corresponds with the object of the cure. The treatment in *febrile* diseases (pyrexia) concerns itself with the *cooling* effect, that in chronic illnesses with the *stimulation* to reaction.

Both objects, as a rule, mutually exclude each other, and in most cases it would be desirable if each could be obtained without the other. If, nevertheless, in the greater number of cases this collision takes place without considerable, and especially without lasting injury, this is explained by the amount of the two effects, and by the nature of the condition of illness subjected to them. In pyrexia the heat of the blood is in itself the cause of danger; the cooling treatment is desired, and stimulation is mostly borne if this main object be obtained. In chronic conditions, however, the cooling is generally too slight to limit considerably the intended stimulation and reaction; in both cases, however, there is no lack of experience of the fatal collision of the influence intended, and its accidental opposite. It may be asserted accordingly, presupposing a rule which admits exceptions, and presupposing a discreet mode of treatment, that in fevers the stimulating effect is endured, together with the cooling one, which alone is intended; and that in chronic illnesses the cooling effect is endured, together with the intended stimulation and reaction, and this without interfering with the object of the treatment.

f. Clinical Character of the Therapeutic Effect of the Cold Bath.—In examining the special indications, it will be shown, as we here anticipate, that everything which hydrotherapy aims at by the methodic use of a series of cold baths, corresponds with the physiological effect of the single bath; namely, irritation of the skin, and from this a centripetal irritation of the nervous centres, and a stimulation of all the functions, from which results an increased production of heat. Here we find, as the result of successful courses of the cold water treatment, improved nutrition and action of the skin, increased tone of the nerve-centres, improvement of the circulation, sanguification, and nutrition, and acceleration of tissue-change.

Therapeutic character.

The selection of cases for hydrotherapeutic treatment is based on two main requirements: 1st, that a considerable withdrawal of heat can be borne, and that the organism concerned is capable of furnishing without injury the reaction demanded from it; and 2nd, that no other

treatment has been proved more advantageous for the special morbid condition and the special case. The more any considerable degeneration of important organs has advanced, and vital functions are interfered with, the more the depressing influence of the withdrawal of heat and the stimulation of exciting forms of baths is felt; and the more, in consequence of such degeneration, or even without it, sanguification and innervation are prostrated, all the less is the organism capable of promoting the required reaction. A certain amount of integrity of the vital functions is the indispensable condition of the cold water cure, and on this amount depends the measure and method of the cure. A great number of cases consequently are unsuited to it: higher degrees of organic heart-disease; pulmonary emphysema; bronchiectasis; important changes in the tissue of the spleen and liver, for example, cirrhosis; chronic bronchial catarrh of some extent, combined with dilatation, and inclination to acute attacks; degenerations of the kidneys; diabetes; cancer; all high degrees of anæmia and exhaustion; diseases of the blood-vessels, inclining to apoplexy; sclerosis and softening in the nervous centres, and all high degrees of degeneration in these. But just as little as all counter-indications can be exhausted in a list of maladies, can all the indications be enumerated in favour of a cure so effectual, and, moreover, comprising so great a number of forms and methods. All that other and universally preferred methods afford, for example, in scrofulous predispositions, in the beginning of pulmonary phthisis, in rhachitis and other maladies of nutrition, and in various conditions of weakness, may result in many cases from some modification of the cold water cure, either through dietetic measures or through methodical treatment. The indication, however, and the treatment cannot be defined by rule, but are subject to the judgment of the individualising physician; and if in hydrotherapy a remedy is given for several maladies, when the more usual methods have been tried in vain, if thus, with all rational restriction, hydrotherapy is raised into a kind of *universal remedy*, it has not acquired this importance by virtue of the supposed omnipotence of its

remedy, but by virtue of the incalculable possibilities of individual cases. There is no disease which may not present cases in which the physiological effect of the cooling treatment is bearable, and, moreover, suitable and sufficient for a carefully selected therapeutic object. All the more urgently, however, is the physician required to make himself acquainted with the importance and the forms of a mode of treatment, in this sense universal, and above all to become familiar with at least a few water establishments, and with their climate, local arrangements, therapeutic methods, and physicians.

FORMS OF COLD BATHS, AND METHOD OF TREATMENT.

The cold bath treatment comprises a *water temperature* from about 88° Fahr. to freezing point; a *duration of bath* varying from some minutes to about half an hour; a more or less frequent *repetition of the bath*, varying from one to ten or twelve times a day (the latter only in cases of fever); and lastly, a multitude of different *forms of baths*, the number of which has, however, been considerably limited by recent practice, viz, full baths, with or without motion of the water and the body, half and hip baths, partial and entire wet envelopments of the body, friction, with and without the removal of the wet cloth, plunge and shower baths, spongings, douche baths, wave, river, and sea baths, baths in running water, and local baths, with or without movement of the water. As the cold bath acts both as cooling and stimulating, we have to adjust accordingly those modifications of the method, and to decide from experience which of them produces more of the one or more of the other effect, at the same time bearing in mind that both effects, though in different degrees, are necessarily combined with every form of cold bath.

1. *Differences of Temperature.*—Both effects, lowering of the temperature of the blood and stimulation, increase generally in proportion with the degree of coldness of the bath; and in baths of the same temperature the predominance of either of these two effects is decided by the duration, repetition, and form of bath,

Treat-
ment.

Degree of
tempera-
ture.

Duration
of the
bath.

2. *Duration of the Bath.*—With the longer duration of the bath the cooling, but not the exciting, effect is increased. For cooling the blood the bath may be continued as long as the general condition, especially the pulse, permits; as a stimulant, it should be ended as soon as reaction begins, or, if it be then still continued, the more cooling form of the bath should be exchanged for one of a more exciting kind.

Dimension
of bath.

3. *Dimension of the Bath.*—The greater the surface of the body exposed to the cold bath, the more rapidly and strongly do both effects appear, and *vice versâ*. In local baths the depression of the temperature of the blood is comparatively slight, while the stimulating effect is greater, although less than in full baths.

Forms of
bath.

4. *Forms of Bath.*—The still bath produces more of the cooling and the agitated one more of the stimulating effect, on account of the constant repetition of the stimulant of cold; and this fact regulates the selection of the form of bath among those named.

Natural
heat and
cold baths.

5. *The relation of the heat of the body to the effect of the cold bath* is not clear, and we meet with contradictory phenomena. *a.* In fever-cases, when the heat of the body is great, baths of 68° Fahr. generally produce a sufficiently cooling effect; and by frequent repetition of the bath a considerable cooling is endured, without, as might be expected, a repetition of stimulant effect, and consequently of increased production of heat, producing a dangerous reaction opposed to the requirements of the case. Only when, in consequence of the height and continuance of the fever, the tissue of the heart has suffered, death may supervene after a cold bath through paralysis of the heart, whilst it is a well-known fact that cold is all the better borne, and produces all the better effect, the more recent the case is. *b.* On the other hand, persons free from fever endure the cold bath at a far lower degree, but not so frequently repeated, as the fever-cases; and in this respect, it is an essential advantage that in the hydrotherapeutic treatment of chronic conditions we have to aim at a stimulating and not a cooling effect, and that in most chronic cases a cold bath once or twice a day is

sufficient for the purpose of stimulation and reaction; otherwise hydrotherapy would be a failure on account of the superabundance of its cooling effect. *c.* Old people and children bear the prolongation and repetition of the cooling effect still less than healthy middle-aged persons, although, probably on account of defective reaction, they possess a higher heat of body. *d.* On the other hand, a non-feverish person bears the cooling effect better, if this be immediately preceded by an increase of heat through impeded loss of heat, for example, by means of thick covering of the body, and refrigeration is far more endurable in a state of perspiration after the wet pack. *e.* And finally, anæmic persons, and women during menstruation, in whom the natural heat is below the usual standard, bear neither the greater degrees of cold like a person in health, nor frequent repetition of cold like a fever patient.

6. *There are certain practical maxims of treatment* in connection with the above facts and opinions, and these are of decided importance with regard to the treatment of distinct cases, and especially with regard to the choice of the cold water or the thermal system. For the understanding of the latter point, we will here anticipate the general effects of the warm bath, discussed in the following chapter, in contrast to those of the cold bath. The cold bath stimulates by actively exciting the functions; the warm bath stimulates by facilitating them physically and physiologically.

Practical
maxims.

a. It is not the greater or lesser natural heat in itself, but the accompanying conditions of the organism, which in children, old people, and in anæmic persons, or in menstruous women, cause the feebler resistance to the effect of the cold bath; and for such individuals the cold water cure, at any rate the more energetic forms of it, are forbidden.

b. If with this indispensable moderation cold water cures are nevertheless carried out with success, this is owing partly to milder forms of baths and in general to a gentler treatment, and partly to a form of bath which prevents refrigeration, namely, by warmly covering the body after the cold bath, or by the use of the wet pack, a method attended

with the gradual warming of the sheet surrounding the body.

e. A mild form of bath is also produced by the mitigation of the stimulus of cold, namely, by the gradual cooling of a bath at first warm; a form which, tested in the treatment of fever, ought not any longer to be discarded from use in cold water establishments, in cases of chronic illness.

d. Every sick person consigned to the water-cure, to a certain extent requires moderation in treatment, on account of his disease and its consequences; and this explains the predominant preference in the institutions in question for such forms of baths as exempt the body, up to a certain extent, from the prolonged refrigeration produced by the bath, or heighten the heat of the body previously to the cold bath, in order to compensate for the loss without injury to the sick person.

e. As heat partly in itself facilitates the vital functions, and partly is itself the expression of increased organic activity, that time of day ought to be chosen for the daily use of the cold bath, in which natural heat is on the increase, that is, the morning. The balneotherapeutic method generally is in accordance with this requirement, although it may have been originally guided by other considerations, especially by the idea of the necessity of a fasting state of the stomach. This, however, is no necessary condition as regards reaction, but only relates to the possible admission of blood into the veins of the abdomen, and thus, whilst a slight morning meal is generally well borne, the work of digestion after a larger meal is certainly unfavourable to the effect of the bath.

f. If a hydrotherapeutic course of treatment, i.e. a series of cold baths, is to fulfil its object, as much nutrition at least must be supplied to the blood during the course as is demanded for producing the reaction, and for overcoming the daily refrigeration. Wherever this is not the case, whether it be that the sickly state of the organs impedes nutrition, or that the accompanying conditions of the course of treatment, the diet, air, exercise, &c., do not supply what is required, then the organism declines, be-

cause it at first feeds upon its small resources, and when these are exhausted it receives no supply from without; it runs into debt, and bankruptcy is often unavoidable.

g. Very frequently an exhaustion of this kind is the final result of the cold water treatment, in spite of the correctness of the indications, in spite of the correctness of the system, and in spite of the good and hopeful success in the first instance, because in many cold water establishments the unfortunate custom often prevails of continuing the treatment too long, or of endeavouring to cure the case at once, instead of distributing the attainable result, according to empirical prognosis, through several courses of treatment.

Why is it that in ordinary life, colds are so often produced by the casual effect of dry and wet cold, and so rarely in the methodical application of hydrotherapy? The explanation of this fact is plain from all that has been before stated. Most colds arise from cold locally applied, because the more locally limited is the refrigeration of the skin, the less is the general production of heat and reaction. General refrigeration also gives cold after being preceded by violent muscular effort, in spite of the generally heightened temperature of the blood, because by increased muscular activity, especially of the heart, the qualifications for reaction are diminished, whilst previous passive warming, without muscular action, produces the contrary effect. A cold bath after violent exertion is always dangerous; after being warmly wrapped up, its effect is increased and facilitated. Colds.

C. EXAMINATION OF INDICATIONS.

1. *Febrile Diseases.*—The antipyretic treatment of fevers (see page 97) aims solely at the generally cooling effect of the cold bath in the withdrawal of heat, and it regards the stimulating effect and importance of the reaction only as an accidental adjunct for modifying the treatment according to the requirements of the individual case, according to the prevalence of the synochal or the Acute fevers.

Hectic
fever.

asthenic character. More accurate remarks on this point do not fall within the limits of our compendium.

2. *Transition from Febrile to Chronic Illnesses: Hectic Fever.*—In many chronic cases an accompanying fever in a hectic form appears as an essential element, and establishes indications of its own. Until recently, hectic fever has generally been attributed to loss of the juices, whilst at the present day the cause is supposed to be infection of the blood with pyrogenous matter, as in acute fever. Yet for the time this theory may be set aside as regards treatment, as at any rate the danger is recognised, not in the quantity of the juices lost, but in the height and duration of the fever-heat; and everything which has proved serviceable in the alleviation of hectic fever corresponds with this view. Quinine, digitalis, wine, cool applications, have an effect in moderating the temperature, and rich supplies of nourishment ought to compensate for the loss produced by the heightened process of combustion; and if, as is usual, warm baths are prescribed for local illness, the cooler forms of the thermal system are chosen if the fever be more prominent. Hectic fever as such, therefore, demands, (1) sufficient compensation through plentiful nourishment; and (2) lowering of the temperature of the blood by dietetic, pharmaceutic, and balneological means.

In most cases, however, the general condition of the patient, as well as the complications of the case, do not allow a vigorous form of the cooling treatment; one, or at the most two, shower baths or cold packings daily form, as a rule, the limit of what can be endured, and but rarely is consignment to a cold water establishment required and permitted, as the arrangements there correspond but little with the requirements of a person suffering from hectic fever.

The antipyretic treatment of hectic fever has as yet made but a few timid advances; it has, however, proceeded most boldly in a malady, with regard to which hitherto such treatment was most dreaded, namely, in pulmonary consumption. With the help of the thermometer we shall here also, it is to be hoped, in a short period overtake the advance made in the treatment of acute fevers.

3. *Chronic Diseases.*—The practical principle of hydrotherapy has been explained in the present chapter under A and B, and its essential forms have been mentioned. Two of the latter we have still especially to bring forward, namely, the *local application of cold*, and the combination of *sudorific processes* with the withdrawal of heat. The former aims at limiting the cooling and stimulating effect to a part of the body, or at bringing it predominantly upon one part, and the principal means for this are local douches, local bandages, and especially hip-baths. We may assert generally that with the use of such means the local effect is more considerable, because the treatment can be borne for a longer period; that the withdrawal of heat, however, does not affect the whole body, and therefore does not act so excitingly in producing general reaction.

General
dynamics.

The *producing of perspiration* previously to the cold bath is effected by means of packing in wet and air-proof sheets, or in dry woollen blankets, and by hot air or vapour baths, and it is maintained by plentiful water-drinking. Its object is either the lixiviating effect of copious perspiration, or the facilitation of the stimulating effect produced by the cold bath that is to follow. After the heating process has continued for some time, the heat of the body is raised from 1.8° to 3.6° Fahr., and it can then so vigorously withstand the influence of the sudden cold, that on the withdrawal of heat it does not fall below the normal temperature. For this reason the period for the refrigeration ought not to be arbitrarily chosen, but it should concur with that in which the greater natural heat is still continuing. The producing of perspiration previously to the cold bath is employed in order to facilitate reaction, and even under certain circumstances, to render it superfluous. From the above-mentioned stimulating and cooling effects of various forms of baths, from the different measure of their application, from the increase and diminution of their degree during the course of the treatment, from the combination and succession of baths of similar or opposite effect, according to the requirements of the case,

there results a fundamental character of effect for each separate case.

The direct influences afforded by the system may be expressed in the following statements:—

A regular alternation of the phases of excitement and repose.

A degree of calming and a degree of stimulation, surpassing in the stronger forms of baths any similar effect produced by other methods of treatment, and permitting at the same time a more abundant choice between higher and lesser degrees than most other modes of treatment.

Powerful and direct refrigeration of the entire body and of different parts, especially of the skin, with prolonged contraction of the vessels and local anæmia, or with quickly ensuing dilatation of the vessels and local hyperæmia, according to the modifications of the treatment.

Powerful excitement of the whole vascular and nervous system, stimulation of the vital functions, of the secretions, and especially, in consequence of the reactionary hyperæmia, of absorption, for which a certain degree of dilatation of the vessels is necessary.

Lixiviation of the blood and tissues by perspiration and drinking.

Increased physical exercise, less dependent on the prescription of the physician than called for by the necessity of compensating for the loss of heat.

In most cases, acceleration of the change of substance, and in a few cases, when the treatment is limited to the milder forms of refrigeration, its retardation.

Thus, on the whole, there is a wide circle of means, methods, and general indications, comprising the greater number of the requirements to be taken into account for chronic diseases. More than in any other method of treatment, however, the individualising art of the physician is required. If, as appears from the above sketch, the cold water cure intrenches upon the efficacy of almost all other balneotherapeutic remedies, the prescription of a cold water cure is in many cases easy without danger, presupposing that *the establishment*

selected affords a guarantee that each case is treated according to its special requirements; and, if anywhere, it is necessary that in this respect physicians should be personally acquainted with the advantages and disadvantages of different establishments, which present the greatest and most serious differences as regards their climatic position, their arrangements and medical directors. Above all, physicians ought to make themselves thoroughly acquainted with hydrotherapy, in order that they may bring about a salutary and organic combination of this branch of art with the entire system of medicine, a combination which alone can free hydrotherapy from the stain of uncertainty and speculation, which still clings to it.

From the preceding general remarks on hydrotherapy, it is evident that the series of the possible class of cases suited for it are not to be exhausted by a list of maladies. We will, therefore, mention only a few, and an especially important class of cases for its application.

1. *Chronic Metallic Poisonings.*—In these the water-cure is the principal remedy, with the restrictions mentioned at page 72, especially a high degree of anæmia. The treatment in these cases consists of two essentially different means, though co-operating for a common object: the lixiviation of the blood and tissues, especially those of the liver, by plentiful water-drinking and the production of perspiration; and the stimulation of the vital functions by exciting forms of baths, the degrees of which are to be made dependent on the power of reaction. When the latter treatment is allowed, the state of the stomach may in many cases forbid plentiful water-drinking, and then a course of sulphurous water may be combined with the stimulating forms of baths, the effect of sulphurous waters being produced by smaller doses.

Metallic
poisoning.

2. *Hypochondriasis*, combined with immoderate sensibility to the integrant vital stimulants, especially to atmospheric influences, and for the most part proceeding from deficient function and nutrition of the assimilating organs and of the skin.—Here, also, the cold water cure, restricted for the most part to a slightly exciting mode of treatment, is one of the principal reme-

Hypo-
chon-
driasis.

dies. Many other modes of treatment also, however, *compete* with it, in so far as they likewise aim at moderately stimulating the vital functions, tissue-change, nutrition, invigoration of the skin, and strengthening of the physical and psychical activity of the nervous system. These are country life, travelling, sea-bathing, thermal sool baths, baths of a moderate temperature, and even chalybeate springs, gymnastics, &c. With regard to these alternatives, we refer the reader to the following chapters, especially to the sketch of the so-called hæmorrhoidal conditions in the third book, where we speak of the waters containing sulphate and carbonate of soda; but above all is required the individualising skill of the physician, which finds one of its most difficult tasks in the appreciation and treatment of hypochondriacal cases.

Hysteria.

3. *Hysteria*.—Our insight into the nature of this malady, though still imperfect, has been of late considerably advanced, in so far as justice is at present done to its independent nervous side. In former times regarded as a disorder of the mind, it was later by many gynæcologists considered as a symptom of uterine and ovarian disease. The more, however, attention was directed to sexual maladies, the more the cases were multiplied in which hysteria appeared without local disease, and local disease without hysteria. The principal phenomenon in hysteria, as in hypochondriasis, consists in an excessive sensitiveness to all integrant vital stimuli, but combined with psychical excitement and varying vivacity, whilst the hypochondriacal mind inclines more to melancholy; and in addition to this, there is another symptom peculiar to hysteria, namely, the inclination to spasms of a peculiar kind, which, in most cases, are to be traced to an irritation of the medulla oblongata and of the cervical portion of the spinal marrow. Hysteria, for the most part a spinal irritation, is in many, but in nowise most cases, combined with disturbance of the sexual condition. In the latter cases local treatment is to be tried; in all others, however, and in these after successful or fruitless special treatment, general measures are necessary in order to attack the neurosis according to its own nature.

Amongst the numerous methods of treatment, the water-cure has of late gained ground, and the celebrated gynæcologist, Scanzoni, is amongst those who recommend it. It is a matter of course that in this illness nothing is gained by much water-drinking and perspiration, but that the treatment consists in the use of the milder forms of bath, both exciting and calming, of course according to individual circumstances.

The *competing modes* of treatment are numerous. In the first place, sea-bathing, which is often injurious, owing to the too powerful incitement which it affords to change of substance in proportion to the feeble organism, and to the impossibility of graduating the remedy; then the thermal sool-baths of Rehme and Nauheim, in cases where weakness predominates, where paralysis occurs, and where the reflex symptoms admit the strong stimulant of carbonic acid; also warm and tepid baths, those containing common salt or soda as well as those belonging to the class of indifferent thermal baths, always with the limitation that the irritability does not demand heat but the withdrawal of it. Lastly, the general remedy is, country residence, mountain air, travel, gymnastics, and, above all, psychical influences; among which implicit confidence in the new medical treatment stands foremost.

Various
methods of
treating
hysteria.

4. *Atony of the Skin, or Skin-Weakness.*—Here the skin is tender and feebly nourished, and responds to the slightest atmospheric influence, sometimes with rheumatic pains, sometimes with catarrhs and congestions, the latter especially in the intestinal mucous membrane, and appearing as neuralgia and intestinal catarrh. Here also the cold water treatment, consisting of friction, especially after perspiration, is the main remedy. This, in serious cases, stands in competition with only two others, namely, sea-bathing and the thermal sool-baths of Rehme and Nauheim, while in slighter cases milder measures are sufficient, such as river-bathing, wave-baths, and mountain travel. Sea-bathing is to be preferred when speedy and vigorous nutrition of the whole body is required, but the thermal sool-baths are best in complicated

Skin-
weakness.

cases where convalescence is difficult, where paralysis has appeared, and in those extreme cases in which the application of cold water always produces cold.

Chronic
exan-
themata.

5. *Chronic Exanthemata*.—The insufficiency of all former modes of treatment in curing chronic exanthems had called forth till about thirty years ago a countless number of vegetable and minerable remedies; but in truth only five or six of all the old and new remedies remain which afford any basis for a really successful mode of treatment; those taken internally are arsenic, mercury, and iodine, and those used externally are water, sulphuret of lime, potash, soap, and the preparations of tar. It is the merit of Hebra to have unmasked the delusions of centuries, and by indescribable industry have introduced modes of treatment by which the path has been opened to numerous and successful results. Above all things, Hebra's practice was based on the principle that it is not the remedy, but the method of using it, that leads to the desired end; and daily experience exposes the dilettante practitioners, in whose hands soap and tar remain ineffective remedies, because they have not perseverance enough to pursue the laborious mode of treatment carried out by the master.

Baths have at all times been regarded as important remedies, and there is no bath which has not been successful in curing one or more kinds of chronic exanthemata. In slighter cases the most different baths accomplish the desired end, and this sometimes in severer cases, when a course of treatment is continued of baths of two, three, or six hours' duration. As this energetic treatment is forbidden in many cases, and the result may be better obtained by other means; as, moreover, the common salt contained in the sool baths very often produces a too violent irritation of the unhealthy skin; and as, lastly, belief in supposed effect of sulphur-baths has likewise been proved imaginary; warm baths have lost much of their prestige in the treatment of exanthemata, and, on the other hand, the powerful effect of cold water has secured to the water-cure one of the most important positions in this branch of science. And here, also, it is Hebra's merit to have established indications and

methods of treatment, which the one-sided system of universal hydrotheraphy could not have done. We shall briefly mention the most important points according to Hebra's work, excluding, however, the various forms of scrofulous eruptions, which, from their nature, require sea-bathing, sool-baths, and thermal sool-baths, unless, from the excessive irritation of the skin, contact with salt water be contra-indicated.¹

Seborrhœa requires in the first place the removal of the accumulated hardened masses of sebum, by weak solutions of potash, or potash-soaps, and then the contraction of the gaping orifices of the ducts by means of cold water, best of all by means of cold douches and cold ablutions.

Local Perspirations, especially of the Feet.—Hebra, as is well known, rejects the old belief which regards suppression of perspiration in the feet as the cause of attacks of cold; and if he allows colds to arise from the feet, he nevertheless denies that the suppression of perspiration is the cause of illness. The treatment consists in ablutions with cold water, cold foot-baths, and full baths, and the application of a liniment of equal portions of melted diachylon plaster and linseed oil. The treatment is unsuccessful, however, in many cases, even after years of perseverance.

Urticaria.—Chronic urticaria is for the most part the result of general causes, especially of the transition from winter to spring, of certain articles of food, of irritation by worms, and, in women, of sexual disorders. When these causes are removed, or when they cannot be removed, the local disease must be cured or alleviated by local treatment, and for this purpose cold is the only effective means—light clothing, light bed-covering, cold ablutions, douche baths, river-baths, and sea-baths. Yet the malady often resists all attempts at cure, unless a change be made in the mode of life and residence.

Furunculosis.—Both warm and cold baths can only rarely be used, and that with great caution, because all irritation of the skin increases the evil. Vapour-baths

¹ See the chapter on Sool-baths.

especially are to be avoided and all friction of the skin as well as strong douche-baths: for these easily produce furunculosis, the disease, as is well known, being frequently the result of excessive water treatment.

Psoriasis.—Of internal remedies, arsenic is the only effective one: it cures many cases, but it does not prevent recurrence. Permanent recovery is only obtained by local treatment. All *balneorum* baths may occasionally for a short time remove slight attacks of psoriasis, but neither sulphur-baths, nor soda-baths, nor iodine baths, nor ordinary thermal baths have been found specifically effective, unless the patients, as at Leukertsd and elsewhere, remain six or eight hours uninterruptedly in the bath.

The other local remedies are potash, soap, tar, sulphuret of potash, bichloride of mercury, and the cold water cure, which in many cases is appropriately combined with the application of one of the other local remedies. Hebra prefers the old Priessnitz method of treatment for psoriasis: a piece of oil-skin or gutta percha paper is spread over the bed, over this two bandages or long towels, upon these a woollen blanket, and upon this a linen sheet dipped in cold water and wrung out. Upon this the sick person is laid, without clothing, and with an urinal placed between his legs. The sick person is now completely wrapped up, so that only the nose, mouth, and eyes are left free; a plentiful perspiration soon begins, and this is promoted by abundant water-drinking, and is kept up for three or four hours. This is succeeded by a cold bath, with movement of the limbs and strong friction, and douches, and then by a walk in the open air. This treatment is pursued twice within twenty-four hours, morning and afternoon. Hebra has found success attend all cases in which this rather troublesome mode of treatment has been carried out, in extensive psoriasis.

Eczema.

Eczema, in its various forms and localities, is the most frequent of all chronic affections of the skin; it is often one of the most obstinate, and it is always one of those which are attended with greater irritation and irritability of the skin. It generally requires strong remedies and

severe methods of treatment, such as a careful course of lead remedies and a preparation of tar. For the alleviation of one of its most irksome, burdensome symptoms, namely, itching of the skin, very simple, quieting, luke-warm baths are often sufficient; the application of cold water likewise meets this symptom, and is also, if persisted in, capable of curing the malady. Cold fomentations, baths, and douches, are the forms of applying it. On the other hand, the means for producing perspiration, which are permitted and useful in non-irritable psoriasis, must be avoided in eczema, and equal attention must be paid to the fact that the water used should have as little salt in it as possible; hence rain and river water are to be preferred. Practical physicians, who are acquainted with the current literature on skin-diseases, and who are not unfamiliar with their treatment, must read with painful astonishment in special balneological works the recommendation of all existing baths, even the strongest sool-baths, for forms of eczema.

Prurigo is an entirely independent disease, affecting the layer of skin forming the epidermis; a drop of inter-cellular fluid raises the epidermis into a small knot, and excites the nerves of the papillæ, producing an itching sensation. None but external remedies have been useful in counteracting prurigo, and those only which produce softening and removal of the upper layers of the epidermis. A cure is most speedily effected with soft soap; less rapidly, but still with tolerable certainty, by means of sulphur, sulphuret of calcium, tar, or creasote. Preference is, however, to be given to *any methodical application of water*, whether this be in the form of cold baths, douches, and river-baths, or in that of vapour-baths or simple tub-baths: in all these methods water is proved to be efficacious, presupposing that the treatment is continued long enough. 'For this reason, every sufferer from prurigo, in every bathing resort, of whatever combination the spring may be, will certainly find relief if he bathe long enough.'¹

Prurigo.

¹ Hebra.

Pemphigus.

Pemphigus is not only an obstinate, but often a fatal malady. Recoveries are, in Hebra's experience, rare; and these only result from the vigorous application of tar, from continuous lukewarm baths (100 days and more), and from the hydropathic system, consisting of cold fomentations, wet bandages, and slight shower baths.

Purpura.

Purpura Simplex.—There is no remedy for the absorption of the extravasated fluid when it is once formed; for the prevention of fresh extravasations, the best remedy, besides attention to the general causes of it, is to be found in stimulating the action and the nutrition of the skin by means of cold baths, douches, and exercise in the open air, which latter is, when it is possible, to be preferred to repose.

Summary as to skin-diseases.

In the above extract from Hebra, not only that which is worth knowing with regard to the great importance of the cold water-cure for chronic diseases of the skin is pointed out, but justice is also done to the whole range of balneo-therapeutic treatment with respect to these maladies; and this chapter relieves us of the necessity of returning at length to the subject of chronic exanthemata in our notice of different baths.

Gouty and rheumatic exudations.

Gouty and Rheumatic Exudations.—We have already (p. 73) spoken of the direct treatment of gout by the internal and external application of cold water. Gouty and rheumatic exudations can, in a therapeutic respect, so far be classed together, as both correspond in their position in and on the joints, in their obstinacy, perhaps even often in their nosological nature, and at any rate in the remedies employed. Our own experience is not in favour of hydrotherapeutic treatment in the severer forms of these affections. They generally point to defects in the constitution, which is further weakened by the suffering, the prevented exercise, and other complications often attending such joint-affections. Anæmia and irritability, with weakness and feeble circulation generally, are seldom absent, and the system is unable to respond to the demands made on it by the treatment in question. In *mild* cases of this nature, however, occurring in otherwise good constitu-

tions, local douches and wet bandages are preferable to most other courses. The more, however, the extent of the exudation and the general complications have weakened the strength of the invalid, the more must all attempts at perfect recovery be set aside, and that which is attainable must be sought for by milder remedies, such as warm baths, mud-baths, and the internal use of mineral waters. Especially, however, we would warn against the use of hydrotherapy in arthritis deformans, a malady which proceeds from a very high degree of anæmia and cachexia, perhaps even from a chronic infection of the blood, and which has nothing in common with gout and rheumatism, but the external appearance. None but the gentler forms of the thermal system, with a course of waters, especially Karlsbad water, effect in slight cases a recovery, and in severer ones an improvement. A special form of it, namely, arthritis deformans of the vertebral column, will find its place in the following chapter, under the head of the paralytic affections.

In cases of chronic muscular rheumatism, also, the cold water treatment has proved itself not infallible. The reason is, perhaps, at any rate in some of the cases observed by us, in the incautious exposure of the sick person to atmospheric influences. Whilst, for instance, in the use of warm baths, the patients are enjoined prudence, both by medical prescription and by their own instincts, they expose themselves in cold water establishments to almost every weather; and, in addition, several of the most frequented establishments are remarkable for their very unfavourable local climate. Another reason lies in the nature of the malady. On the whole, the prognosis is unfavourable, and a single course of any treatment rarely effects a permanent cure. In the cold water institutions, however, the bad habit still frequently prevails, of too greatly prolonging the course of treatment in the desire of curing the sick person once for all, instead of dividing the result attainable over a series of courses.

So far as *delicacy of skin* may be taken into consideration in chronic rheumatism, we do not wish to lessen the prestige of the cold water cure, but in general for rheu-

Muscular
rheuma-
tism.

matic cases indifferent thermal baths, moor baths, thermal sool-baths, sea-baths, and the like, are more suited.

Paralysis.

7. *Paralysis*.—The principal remedy prescribed by past experience and confirmed by that of recent times, is *heat*; cold, as such, *i.e.* in its property of withdrawing heat, may relieve general and local weakness, but not actual paralysis. Peripheric paralyzes proceeding from an enfeebled condition of the nerves in their peripheric course, are extremely rare; what is called rheumatic paralysis is for the most part muscular atrophy, in consequence of muscular rheumatism, or the emaciation of an extremity from impeded use through disease of the joint. Most cases of paralysis are of central origin, and proceed either from the brain or the spinal marrow; and even those arising from pressure on the great pelvic nerves resemble those of central origin both in prognosis and in treatment. The remedy in most cases consists in centripetal irritation of the nerves of the skin, in order gently to awake the function in the centre; and the great impressionability of the central nervous organs forbids the more violent action of cold; and this is also the case if absorption of exudation in or upon the central organs is to be effected. We will not deny that, in some cases of exudative meningitis of the end, a course of cold water treatment, promoting absorption, has proved successful; but we possess in the thermal baths, especially in the thermal sool-baths, a safer remedy, free from the risk of over-excitement. We would, moreover, mention that in slighter cases of hysterical paralysis, and in some of paralysis of the bladder (Scanzoni), the cold water system has been beneficial, that occasionally hæmorrhoidal congestion of the spinal marrow, and the paresis proceeding from it, have been diminished; but in most cases the thermal treatment is greatly preferable; and in apoplectic paralysis, tabes dorsalis, and reflex paralysis, the water-cure must be decidedly forbidden.

Of all conditions of weakness to be classed with paralysis, *impotence* is the one that best deserves to be assigned to the cold water system, and it is not to be disputed that cold bathing of the spine and cold hip-baths have sometimes been attended with success. In *deficient menstruation*, when it does not proceed from general anæmia,

but from local atony of the uterus and ovaries, the hip-bath is the principal remedy; also in leucorrhœa, when it does not arise from organic disease of the uterus.

8. *Syphilis*. See p. 73.

Syphilis.

9. The use of cold enemata in *habitual sluggishness of the bowels*, of cold hip-baths in the same case, and in chronic *prostatitis*, and of *warm* hip-baths in catarrh of the bladder, is well established in medical practice.

Rarer indications.

10. The effect of hydrotherapeutics in cases of *sciatica* is as uncertain as that of all other modes of treatment; successes are met by failures just in the same measure as is the case with the various forms of thermal treatment, galvanism, and internal remedies.

COLD WATER ESTABLISHMENTS.

In a compendium intended for the medical public, an enumeration of some of the best known water-establishments may be desirable for the convenience of the reader. and we may be permitted to point out some advantages of position and arrangement: to enter further into the matter, however, and to mention the special disadvantages and deficiencies of some of the establishments, is forbidden alike by discretion and by justice. Every practitioner should become acquainted with a few establishments, and should know their arrangements, their climatic conditions, and their physicians, either personally or from reliable inquiries; and every practitioner should also study the method of treatment. We would expressly state that our list in nowise lays claim to perfection.

Cold water establishments.

Nassau (in the former duchy of Nassau; station on the Lahn railway, not far from Ems), one of the more recent establishments, situated in the basin formed by the widened valley of the Lahn, with a mild and equable climate, well suited for a limited number of invalids, and roomy in its arrangements. Besides its arrangements for cold baths, there are pine-leaf baths, Roman-Irish baths, a gymnastic hall, and two pneumatic apartments with condensed air. Physician, Dr. Runge.

Laubach, on the Rhine, half-an-hour above Coblenz,

one of the larger and much frequented establishments. Physician, Dr. Schüller.

Near *Boppard*, a station on the railway running along the left bank of the Rhine, there are two establishments, both of great extent and much frequented, namely, *Marien-berg* (Dr. Burkard) and *Mühlbad* (Dr. Heusner).

Godesberg, connected by railway with Bonn, combines with the advantages of the establishment, those of a comfortable country residence, the vicinity of the university town of Bonn, the possible use of a chalybeate spring, and excellent, temperate, and careful medical direction. Physician, Prof. Finkelnburg. The place being a climatic health-resort, affords to invalids numerous apartments in hotels and private houses, besides the establishment itself.

Johannisberg, in the Rheingau, below the castle of the same name, a quarter of a mile from the railway stations Wiukel and Geisenheim, and sheltered by the Taunus from the north winds, also possesses an apparatus for condensed air, and arrangements for vapour, pine baths, and other baths. (Physician, Dr. Marc.)

Wiesbaden possesses, in addition to its hot saline springs, later to be mentioned, two large cold water establishments: *Nerother* (Dr. Cohnfeld) and *Dietenmühle* (Dr. Genth).

Alexandersbad, near Wunsiedel on the Fichtelgebirge, 1,754 feet above the level of the sea, in a splendid mountainous situation, about six hours from Hof, and five hours from the railway station of Schwarzenbach, is one of the most frequented establishments, possessing also saline steel springs and pine-leaf baths. (Dr. Cordes, proprietor; Dr. Jahn, physician.)

Liebenstein, in the Thuringian forest, duchy of Meiningen, 1,000 feet above the level of the sea; mild summer climate, with beautiful woods, whey establishments, pine-leaf baths, sool-baths, and a gaseous chalybeate spring.¹ Station, Immelborn on the Werra railway, an hour distant. (Drs. Döbner, Hesse, and Siebert.)

Ilmenau, near the Thuringian forest, in the woody valley of the Ilm, 1,500 feet above the sea, two hours

¹ See Book III.

distant from the Arnstadt station. The establishment itself accommodates for the time only twenty invalids, the rest live in the town. Besides the cold water establishments there are pine-leaf baths, whey and other remedies. (Dr. Baumbach and Dr. Preller.)

Königsbrunn, at the foot of the fortress Königstein, 483 feet above the sea, in the centre of Saxon Switzerland. The situation is sheltered and picturesque, and the establishment, with its boarding house, is much frequented. (Dr. Putzar.)

Sweizermühle, likewise in Saxon Switzerland; Pirna and Königstein stations of the Saxon-Bohemian railway. (Dr. Moldau.)

Tharand, near Dresden. (Dr. Biehayn.)

Gräfenberg (established by Priessnitz), in Austrian Silesia, near Freiweidau, 1,500 feet above the sea; raw climate. (Dr. Schindler.)

Lauterberg, near Klausthal, in the Upper Harz; much frequented; rational treatment. (Dr. Ritscher.)

Hubertrisdal, near Thale, in the Lower Harz. (Dr. Preiss.)

Sophienbad, near Hamburg. (Dr. Andresen.)

Schönsicht, in Frauendorf, near Stettin. (Dr. Brand.)

Herrenalb, near Wildbad in Würtemberg.

Gleisweiler, in the Rhenish Palatinate. Landau station. Grape, whey, and cold water establishment. (Dr. Schneider.)

In Switzerland.

Heiden, in the Canton Appenzell, above Lake Constance, 2,660 feet.

Albisbrunn, near Hausen, in Canton Zürich, 1,955 feet. Whey. (Dr. Brunner.)

Felsenegg, in Canton Zug, 3,000 feet. Whey. (Dr. Kaiser, of Zug.)

Engelberg, in Canton Unterwalden, 3,340 feet. Whey. (Dr. Cattani.)

Brestenberg, in Canton Aargau. (Dr. Erismann.)

Rigi Kaltbad, 4,480 feet, much frequented; hotel and boarding house.

There are hydropathic establishments in some of the most healthy situations of *England*, as *Ben Rhydding*, *Foley Villa*, and others near *Foley*, in *Yorkshire*, where the elevated situation and the bracing air of the moors considerably aid the effects of the water cure. Almost as good is the situation of the well-known *Malvern* establishment, to which we may add those at and near *Matlock*, and at *Southwell Park*.

In *Scotland* the establishment at *Wemyss Bay*, not far from *Greenock*, is much visited, and not less so that in the interesting town of *Ferry*, near the *Moray Firth*, and another one of considerable dimensions at *Crieff*.

It is greatly to be regretted that in *England* so little intercommunication exists between general scientific medicine and hydrotherapeutic practice which is to be regarded as an important branch of the former. The so-called Hydropathic establishments ought not to be merely a kind of boarding house for the benefit of the proprietor, but the effect of the different methods of treatment employed in them ought to be carefully studied, and the results communicated in the regular medical literature, as is now being done in *Germany*. The fault may partly lie with our own profession, which seems afraid of connecting itself with a practice which formerly has been carried on in a rude, empirical manner, and in opposition to so-called rational medicine; but if the profession were to take up the matter, it could found establishments where the principles of hydrotherapeutics would be carried on in a scientific way, principles which would perhaps be modified by the intercourse with general medical practice, and which would, on their part, exercise a great influence on the latter.]

CHAPTER VIII.

ELEMENTARY EFFECT OF WARM BATHS—CHARACTER OF THE
THERMAL SYSTEM—THERMAL, VAPOUR, AND SAND BATHS
—DOUCHE BATHS.

A. ELEMENTARY EFFECT OF WARM BATHS.

WHILST cold water contracts the muscles and capillary vessels of the skin, and of those tissues upon which the immediate effect of the cold is felt; and while, after the cessation of the cold stimulant, the contraction is succeeded by dilatation of these vessels, and local anæmia gives place to hyperæmia, the mechanical process is just the opposite in the local influence of heat; the tissues relax, the capillary vessels become at first dilated and congested, and, after the cessation of the stimulant of heat, contraction of the vessels and renewed acceleration of the circulation follow. In both cases, however, the final result is about the same; namely, an increased circulation in the skin and parts accessible to the physical influence of the bath.

Effect
on the
vessels of
the skin.

The cold bath, by contact, deprives the body of heat; the warm bath (apart from any definite degree of heat, and considered as such only in contrast to the cold bath) increases the heat of the body, partly by direct supply, and partly by diminished radiation and evaporation. Both changes in the natural heat, both the decrease in the cold bath and the increase in the warm bath, are, as is the case in warm and cold atmosphere, within the limits of a few degrees, because the involuntary process of compensation going on in the organism, especially by means of perspiration and its evaporation, is opposed to the maintenance of greater extremes of temperature.

Increase of
heat.

Cold baths, which within a certain time diminish the natural heat about 1.8° to 3.6° Fahr., are not so long endurable to the general feeling as warm baths, which in-

crease the natural heat to the same degree ; partly because the sensation of cold is altogether less agreeable than that of heat, and partly because the peripheric contraction of the vessels in consequence of cold produces a more intense congestion in the internal organs, the lungs, heart, and brain, while increased heat, though it distends the vessels and the blood in these organs, draws outwardly, by the peripheric hyperæmia going on at the same time, a portion of the blood from within.

Facilita-
tion of the
functions
by heat.

The difference is important with regard to the oxidation of the component parts of the blood and tissues. The effect of cold, in an endurable and salutary degree, manifests itself in an immediate deepening of the respiration, and retarding of the contractions of the heart ; in addition to this, the air inhaled is denser, and therefore absolutely more rich in oxygen, and thus, by the greater activity of oxidation, not only the internal compensation for the external loss of heat is explained, but also the whole effect upon the change of substance. In the warm bath the case is different ; the amount of air breathed and of oxygen inhaled is less, and in spite of this, the secretion of carbonic acid and water from the lungs is increased ; here also an increased oxidation takes place, but not by means of greater supplies of oxygen and increased amount of the heat-producing functions, but from the purely physical cause of greater heat of the blood.

The example of the different effect of the cold and the warm bath upon the immediate condition of the muscles, places this diversity in a distinct light. A relatively healthy person, whose muscles are enfeebled by long disuse, seeks and finds a stimulant and strengthening of the muscular power in a cold bath ; he becomes inclined and enabled to take more exercise, and thus frequent and judicious use of the cold bath leads to increased tissue-change and improved nutrition. On the other hand, there is no better remedy for painful weariness of the muscles after violent effort than a warm bath ; the weariness of the muscles is due to immoderate accumulation of the products of their functions, for the further oxidation and secretion of which an amount of change of substance is

required, such as the over-wearied muscular fibre can no longer afford; in this case the increased physical heat appears as a momentary means of facilitating oxidation, and a warm bath has often in a moment the effect which, without it, could only have been obtained by days and hours of physical repose. The example of Napoleon is well known, who, after a day of battle, instead of seeking rest in bed and sleep, was wont to take a warm bath, in order to be able to continue the march at night, and to fight another battle on the following day. *Cold refreshes by stimulating the functions, heat by physically facilitating them; and in this treatment lies the important practical difference between the cold water system and the thermal method of treatment.*

Heat is the element adequate to organic life, and its moderate increase stimulates all its conditions and functions. The more heat is withdrawn from the body, the more has it to replace by means of the organic functions; the less the loss of heat, the less is the production of heat required, and the smaller the measure of activity demanded for this purpose. This view is in accordance with the different feeling and condition in winter and in summer, and above all, with the relation of certain contrasts of physical constitution to heat and cold. *Cold is most easily endured* when the production of heat proceeds plentifully, or even immoderately, therefore by healthy, well-fed persons, or by sick people, whose constitutions, from the sound condition of the principal organic functions, correspond with the requirements of all cold water treatment, or lastly, in immoderate production of heat in febrile diseases, and in the stage of heat and perspiration produced by external appliances. In the first case, heat is reproduced by the increased stimulation of the functions; in the second case, it is increased above the normal standard, and by cold brought back to it, without any special expenditure of the functions of life; in the first case, therefore, the effect of cold is stimulating, and in the second calming.

An increase of heat is borne most easily by individuals whose constitutions cannot compensate for the

Physiological
fundamental
statement
with
regard to
the effect
of the
warm
bath.

normal or increased loss of heat without a certain effort and consumption of strength, by individuals whose organic activity is taxed to the utmost by the performance of the ordinary vital functions. While, therefore, the stimulation of cold presupposes a healthy, and even robust capacity for the production of heat, the application of heat has the power of facilitating the organic life which is incapable of this independent work; the stimulation is produced in this case, not at the expense of excited function, but by means of *facilitated* function, and a tranquillising effect is thus produced. This is still more clearly recognised from another point of view. Constitutions requiring heat are not only affected by the absolute withdrawal of heat, but also by the rapid and even normal variations of this physical influence. The loss of heat in different parts of the body is different, through clothing, evaporation, and different degree of agitation of the surrounding air; and this constant variation in the loss of heat forms also a rule of life, in so far as it habitually prevails, and the compensating production of heat has constantly to keep itself in due proportion with it; delicate unresisting constitutions, however, are so sensitive to this variation of heat, that they are injuriously affected by it. Such an invalid, like a man wearied by violent exercise, feels painfully even slight differences of temperature in various parts of the body, and the calming effect produced at once by a warm bath proceeds partly from the *removal of the locally varying loss of heat*, as water of a great temperature throughout sets aside this difference. The effect here is similar to that of sleep, the calming influence of which proceeds from the uniform lowering of most of the functions of life.

Funda-
mental
character
of the
effect.

From the points of view just considered, we may thus designate *the fundamental character of the effect of warm baths* in contrast to cold water ones.

1. The warm bath, during its duration and so long as its primary effect continues, favours by means of the physically increased degree of heat, the normal physical and chemical condition of the cells, juices, and organic tissues.

2. By this means it is possible to stimulate the organic functions, and to increase the change of substance, without demanding a strong reaction, but by merely facilitating the physical conditions of life.

3. Whilst the warm bath lessens the loss of heat, it moderates the normal compensating reaction; and whilst it surrounds the skin with an equable temperate medium, it frees the loss of heat from all variations of time and place, and produces a quieting effect.

4. The circulation of the blood in the skin, and in the parts accessible to the heat, is accelerated just as by the cold bath, though the mechanical process is different.

5. Greater degrees of heat produce a stimulating effect, it is true, upon the heart and brain; but this effect is gentle and is not accompanied with any shock, and, moreover, the congestion in the peripheric parts draws away the blood from the central organs of the circulation and nervous system.

6. In addition to all this, there is the well-known property of warm water of rendering the skin softer, and of purifying it more rapidly, which, however, is likewise the case with those forms of the cold bath which excite great perspiration. And, lastly, we must mention the perspiration-exciting effect of very warm or moderately warm baths, succeeded by warm covering in bed, which produce the same lixiviating result as that aimed at in the perspiration of the cold water system.

7. The warm bath promotes absorption, partly by stimulating the nervous centre, and partly by increasing the circulation and pressure of the blood, and by distending the vessels.

From this fundamental character of the effect produced, it appears that the general therapeutic object of warm baths is about the same as that of the cold water system, but in other constitutions and other individualities, and through another mechanical process. The most general practical maxim is, that the cold water system presupposes a certain soundness of the organic functions, and a certain amount of capability, and that the warm water system

Thermal system compared with the cold water system.

does not make so strong a demand upon the natural active power of the organism.

In one point, however, both these methods of treatment approach very nearly, namely, as regards tranquillising effect; this is common both to warm baths, and to cold baths after sudorification. Many cases allow equally of the one as of the other method; and, as the production of perspiration with a subsequent cold shock is one of the most usual remedies of the cold water system, we can understand the competition of this system with all the other forms of bath treatment. Between the two therapeutic opposites a similar relation exists as between winter and summer life, and between sea and mountain air. The physician who has, to a certain extent, acquired an insight into the diseased side of mankind, divides the chronically sick into two groups, the one consisting of individuals whose organism has sufficient capital to afford the strong reaction required, the other consisting of persons needing nice management, and whose own power cannot be exposed to any great demand; for the one there is the system of exercise, cold treatment, cold baths, sea-baths, and sea-air; for the second indulgence, warm treatment, warm climate, warm baths, mountain air. On the judicious appreciation of such individual differences of organisation depends the success of the practical physician.

Slightly in reality as those two groups of opposite constitutions are divided from each other, just as slight is the gentle and often scarcely perceptible transition between the forms of the two opposite systems of warm and cold water. Many thermal courses of treatment have to do with baths, the heat of which lies below the normal or indifferent temperature,¹ and which therefore produce the effect of withdrawing heat and stimulating to reaction, just as in the cold bath, although of course not in so great a degree. This circumstance appears most strikingly in those baths which are rich in free carbonic acid,²

¹ See p. 93.

² See the Thermal Sool-baths, book ii. ch. ii.

and which often, with a temperature of 25° Cent. (77° Fahr.), create the impression of a temperature of 33–37° Cent. (91·4° to 98·6° Fahr.), which, therefore, so far as the feelings of the bather are concerned, can be endured for a far longer time than simple water-baths of a similar temperature. We have here, apart from other properties, a cool bath, producing the immediate effect which we have found to be produced by the cold bath, but with a peculiar influence upon the sensitive nerves of the skin, in consequence of which the loss of heat is not felt.

B. DIFFERENT DEGREES OF TEMPERATURE OF WARM BATHS.

Karner¹ gives a summary of the primary effects of the different temperatures of baths, which is so exact and comprehensive that we prefer to copy it verbally, rather than use different words.

Classification.

‘1. The effect of the *indifferent* temperature of baths (between 31° and 36° Cent., 87·8° to 96·8° Fahr., according to the individual condition of the baths) is limited merely to the peripheric nervous system, and in so slight a degree that a transmission of this primary effect to the central nervous system, and thence to the arterial system, is not to be perceived. We find, therefore, no change in the frequency of the pulse, the turgor of the skin is not altered, the change of substance, the secretions, and excretions, are neither checked nor stimulated; as no heat is withdrawn from the organism, and that developed in the body is not retained, no reaction takes place, and the natural heat remains unaffected. When, however, the sensibility of the nerves is abnormally increased, and great irritability exists, it is difficult to discover this indifferent point, and at any rate it is confined within narrow limits. . . .

Indifferent temperature.

‘The indifferent temperature of the bath is that which the human organism bears for the longest period without disadvantage, and baths which are continued for some hours, and even for half a day, as is still the custom

¹ *Ueber Badetemperaturen*, Prag, 1862.

in some places in Switzerland, can be administered only at this degree of temperature without injury. The therapeutic effect of the indifferent bath consists principally in the quieting influence which is exercised by the equal regulation of the loss of heat in this bath.

The warm
bath.

‘2. We call that bath *warm* (blood-heat and 2 or 3 degrees Fahr. above it) in which the effect of the temperature passes from the peripheric nervous system to the central nervous and the sanguineous system, producing a reaction which is manifested by a moderately increased afflux of the juices to the periphery, by acceleration of the pulse, though the breathing is unaltered, by slight stimulation of the tissue-change, and by the effect upon the mucous membranes of the respiratory and alimentary organs, without causing a marked change in the activity of the vicarious organs and the renal and intestinal secretions.

The very
warm
bath.

‘3. If these reflex effects upon the central nerves and vessels appear in a higher degree, if the frequency of the pulse be considerably increased, if the respiration be difficult, accelerated, and interrupted by frequent and deep respirations, if a hyperæmic condition of the skin be produced, if the natural heat accumulated and retained within the body call forth a plentiful perspiration; in all this we have the effects of the *very warm* bath, be the temperature of the water what it may. In many people, this effect of the very warm bath appears at a temperature of 37–39° Cent. (98·6° to 102·2° Fahr.), therefore little above blood-heat, whilst in others the same effects are produced only at a temperature of 43–45° Cent. (109·4° to 114° Fahr.)

The hot
bath.

‘4. The *hot* bath is only exceptionally to be prescribed as a remedy, and that with great caution, and the duration of it should only be a few minutes. It serves as a powerful stimulant, and is intended to excite the whole vascular system to the highest degree of activity. The strong stimulus which the hot medium exercises upon the whole peripheric nervous system excites the most violent reflex action of the heart and the whole arterial system. It is especially to be observed with regard to the hot bath, that very great heat directly affects the centre of respiration, and produces parenchymatous degenerations in the

organs, the heart and spleen. That hot baths cause trismus in little children, has been confirmed by numerous experiences.'

C. INDICATIONS FOR WARM BATHS.

If, as we have seen, the fundamental character of the effect of warm baths pursues in general the same object as the cold water system, we find the same *classes* of diseases adopted for the treatment by warm baths, but in more delicate individuals, unable to afford the necessary reaction demanded by the cold bath, and in addition some other diseases which exclude the application of cold. And if we consider the constitution of the present generation, and the complicated and often physiologically unnatural circumstances of their life, if we further consider that a chronic disease in most cases renders the suffering organism that which in the above sense we have ventured to call a nature requiring nice management, we may expect to find that only a small number of individual cases will fall among the class of diseases assigned to the cold water system, and the larger number will belong to those assigned to warm baths; and this theoretic supposition thoroughly corresponds with habitual practice, based upon experience.

General indications in favour of the thermal system.

With regard to the temperature, we need only in general say that under ordinary circumstances the stimulating effect of the bath appears more evident with its increasing heat, and the quieting effect with its decreasing heat, and that the conditions of the individual case must show with what amount of stimulant or quieting management the result of the remedy is to be obtained, and that the more in any chronic case there is an appearance of accompanying hectic fever, the more must the thermal system adhere to the cooler form of bath.

The following indications may be regarded as suitable for warm baths. Whatever addition to the effect is produced by the special chemical contents of the water, will find its place in the next book. The cases and conditions

suited for treatment at the indifferent thermal spas will, however, in the present chapters, be thoroughly discussed, and all that is peculiar to the system and to climatic influences will be here added.

General
weakness
and diffi-
cult con-
valescence,

1. *General Weakness and Difficult Convalescence.*—The nature of *convalescence* after acute and chronic illnesses consists in a certain exhaustion of vitality, and in the restoration of what has been lost, until the former standard has been recovered. All the tissues have lost in amount and weight; the quantity of blood is absolutely diminished; frequently even its separate component parts, fibrine or blood-corpuscles, are lessened; and the functions are without energy. All that *convalescence* is to produce essentially consists in the increased nutrition of the blood and of all the tissues. The outward evidence of this result is expressed in the restored colour of the skin, in the increased weight of the body, and in the restoration of the organic functions; but the course of *convalescence* is slow just because the functions are weakened, and all the slower the more this is the case. In most cases the *régime* prescribed, time, and the instinctively required habits of the convalescent are sufficient for the purpose; and simple, i.e., absolute poverty of blood is the sickness which is most easily and surely cured by nature, whether it has arisen from *convalescence* after severe suffering or from want of food and sufficient nutrition.

Frequently, however, recovery from this condition is beyond the power of mere *régime*, and in this case *impeded convalescence* demands special measures. Either the exhaustion and emaciation have reached such a high degree that the remaining fund is too limited even for slow restoration; or the blood, from special transudations and secretions, has lost so much of its constituent parts that in addition to an *absolute* there exists a *relative anæmia*, oligocythæmia or hydræmia; or the central organs of the nervous system are exhausted and over-excited, so that they cannot bear the slightest integrant stimuli of life; or the skin has become atrophied, and cannot afford the necessary resistance to slight influences of temperature; or, lastly, the organs of assimilation have

renounced their office, either from want of sound innervation or from changes in their own tissues.

In all these cases, as also in normal convalescence, which is to be accelerated for special reasons, certain indications appear which diverge in two directions, but which frequently unite in the medium measures of their remedies. Either great exhaustion is to be remedied by exciting and strengthening measures, or quieting and indulgence is afforded to the morbidly excitable organs by means of soothing remedies; as a rule, however, both these modes of treatment are used in combination, and each individual case requires such treatment as may facilitate the formation of new substance, without too greatly increasing the consumption of that already existing. Neither gymnastics nor laborious travel, nor a methodical course of cold water, can accelerate this retarded convalescence, because such measures make undue claims on the exhausted power of the sick person; but the measures adopted must be a carefully directed diet, with the quiet enjoyment of country and mountain air, residence in a mild climate, with a beneficial mental composure, plans promoting sound sleep, &c.

If these arrangements be not sufficient, special remedies are required, and among these are *lukewarm baths*, and, possibly, with very weak persons, *warm baths*.

Abstraction of heat is quite out of the question, but immoderate heat is also to be avoided. Baths of indifferent temperature, or somewhat above it, best fulfil the object, which consists in equalising the production and the loss of heat, in gently exciting the skin, in quieting or slightly stimulating, according to the individual requirement, the central nervous system through the peripheric nerves, and in gently promoting the change of substance. The more an atonic condition preponderates, the warmer and more exciting may be the bath; the more an *irritable weakness* prevails in the nervous and vascular system, the more necessary is it to use the quieting, pulse-retarding effect of moderate warmth.

All warm baths, let them contain what they will, are adapted for this purpose; simple water-baths, indifferent

thermal baths, alkaline baths, sool-baths, and often also weak sulphur-baths. In sool-baths, the more exciting effect upon the skin and peripheric nerves has, of course, to be taken into consideration; but there are many very weak salt springs where the amount of salt in the bath scarcely increases the effect, and, on the other side, in most bathing resorts the amount can be graduated by dilution. The choice is very great, and may be determined, therefore, by the temperature of the springs, and by the outward circumstances of the place, its arrangements, social mode of life, nearness and distance, and climate.

Indifferent
thermal
baths.

In addition to the *indifferent thermal spas*, we have to consider especially three other means *competing* with them, namely, sea-bathing, a course of iron, and the carbonic acid thermal sool-baths of *Nauheim* and *Rehme*.

Sea-
bathing.

Sea-bathing is chosen when, the organs of assimilation not being otherwise trophically changed, there is want of appetite and emaciation, while, however, the state of reaction is able to compensate for the effect of the cold and violently agitated sea-water. As a rule, the warmer coasts are to be preferred, and in many cases the patient must be satisfied with using tub-baths of warm sea-water while enjoying the sea-air.

Iron.

An *internal course of iron* is often not well adapted to the delicate condition of retarded convalescence. Only in cases when the anæmia of the convalescent has been produced by direct or almost direct loss of blood, for example, by hæmorrhage, pleuritic effusions, or abundant secretions from the intestines, a direct course of iron gains the desired end, and only in these cases is iron generally borne.

Supposed
steel-
baths.

The baths at chalybeate spas, the *so-called steel-baths*, we cannot regard any longer as acting by means of the iron contained in them, for they owe their effect entirely to the temperature to which they are raised, and to the amount of carbonic acid contained in the water.

Rehme
and Nau-
heim.

The *gaseous thermal sool-springs of Rehme and Nauheim* compete with the above-mentioned remedies in those cases especially in which, from considerable anæmia, a direct course of iron is either contra-indicated on ac-

count of complication, or has been attempted in vain. In these springs, with a very moderate temperature, is combined the usually rapid effect of the carbonic acid, exercising, with a slight withdrawal of heat, a centripetal stimulus upon the nerve-centres, and producing a peripheric upon the vessels of the skin. Thus we have with the withdrawal of heat the combined effect of both calming and exciting influences, and this without demanding any violent reaction. The pulse becomes slower, the appetite and nutrition, and the muscular power are increased, and the deficient iron is withdrawn from the food, by which in healthy people the normal amount of iron in the blood is maintained. In numerous other cases, in which the exhaustion extends principally to the brain and spinal marrow, thermal sool-baths are the principal remedy, by their powerful excitation of the nervous system. These cases are especially those of convalescence after acute exanthemata, climatic fevers, acute catarrh of the stomach, typhus, typhoid fever, epidemic cerebro-spinal meningitis, and influenza. In these cases the weakness of brain often amounts to a paralytic condition, and that of the spinal marrow frequently borders on ataxic paresis; and although most of even these severe cases are with time to be cured by Nature herself, yet the acceleration of the improvement by the baths of Rehme and Nauheim is to be recommended, as they generally effect in weeks what in unassisted convalescence would require months and years.¹

If we enter somewhat in detail into the treatment of retarded convalescence by means of baths, we do so because in this case the general effects of warm baths are most distinct and evident, and because the condition is not merely the consequence of acute diseases, but also the accompaniment of almost all chronic illnesses, and hence the maxims for the treatment of retarded convalescence are to be taken into consideration in almost all chronic

Condi-
tions
similar to
retarded
convalescence.

¹ Here we may also especially mention Beneke's recommendation of these baths against the effects of rheumatic fever, amongst which retarded convalescence occupies a prominent place. (*Berliner Klinische Wochenschrift*, 1870.)—Ed.

illnesses. There are, however, diseased conditions, which, without preceding illness, resemble convalescence, and require similar management, for example, imperfect development in childhood, phthisical habit in youth, general emaciation after hard work or after long and depressing mental emotion; premature old age, i.e., destruction of the cells before the normal time, after a wearing life; inclination to abortion, without local cause, and only proceeding from general weakness, &c.

In all these conditions the same maxims may be observed, and the same indications occur as in retarded convalescence; and this condition is, indeed, a model for the general system of any special course of treatment in chronic diseases,

Anæmia.

2. *Anæmia*.—Absolute poverty of blood, which in all cases accompanies general emaciation, has been mentioned above under the head of convalescence, and also the relative diminution of the cells and the fibrine—i.e., anæmia, in the usual sense of the word, has been alluded to; but this disease will, according to general custom, be more fully discussed under the head of courses of iron, when, among other indirect stimulating modes of treatment, the competition of warm and cold baths will be brought forward.

Diseases
of nutri-
tion.

3. *General diseases of nutrition* will be elsewhere more fully entered into; that of scrofula, when discussing soot-baths and gaseous thermal soot-baths; phthisis under the head of Lipp springs and climatic courses of treatment; and diabetes under that of courses of alkaline waters. In these conditions the system of warm and cool baths presents not immaterial indications, though at the same time it has not acquired any universally acknowledged and universally received acceptance.

Gout.

4. *Gout*.—In discussing the cold water treatment, it has been mentioned that in many severe cases, combined with irritable weakness, neither the violently exciting nor the depressing effects of the cold water system could be borne; and that these cases, if baths be prescribed, are especially adapted for warm baths. At the same time however, we must premise the general experience that

gout, i.e., *gouty dyscrasia*, is just as rarely cured by warm baths as by cold, and it is very questionable whether ever a serious case of gout has been cured by any mode of treatment in so short a time that the recovery can be ascribed to the treatment. Nothing but the gradual restoration of the constitution is able to remove this disease; and experience teaches us that courses of cold water and thermal baths are less able to accelerate and assist this slow process of recovery, than the constant repetition of the old-established courses of strong alkaline waters, such as Vichy, or the alkaline saline springs, such as Carlsbad and Marienbad. Nothing but the internal use of these waters is able to moderate the gouty dyscrasia itself. Strong bath treatment, especially with very warm and protracted baths, and strong cold water treatment, can effect this only in those rare cases in which the soundness of the general constitution can support violent stimulation and great reaction; milder bath treatment, with moderately warm baths, may mitigate the attendant conditions of great excitement or great exhaustion. Milder bath treatment, whether pursuing the cold or the warm system, has no influence at all upon extreme cases of gouty exudation; if the exudations have spread over the greater part of the joint, they do not yield to any treatment at all; if their extent be more limited, they can be lessened by strong bath treatment, presupposing that the general condition of the sufferer admits this. Courses of water-drinking are also able to produce a certain amount of absorption of the exudations.

Such are the experiences of practice. They require to be brought plain and unvarnished before the inexperienced practitioner, in order that he may not allow himself to be confused by balneological works, which have always a hundred baths as a remedy for gout, and that he may not be led into fatal experiments and an erroneous prognosis. In old and severe cases of gout we must be satisfied with endeavouring to improve the constitution, and to diminish the exudations if possible.

Prognosis
of gout.

All the measures which we have mentioned in cases of retarded convalescence tend to *relieve the general health*

Recovery
of the

Constitution.

according to the circumstances of the case, and for the reasons stated above the choice lies between simple water baths, sool-baths, thermal sool-baths, and warm sea-baths. Among the indifferent thermal baths the cooler sort are to be preferred for this purpose, especially that of *Schlangenbad*, much neglected for gout, and which, with its baths of 27·5-30° Cent. (81·5° to 86·9° Fahr.), combines a mild and fresh climate and quiet noiseless forest life; and it is utterly false and unreasonable when, just because the hot baths of *Teplitz* effect the absorption of exudations, they are recommended also for the purpose of affording a general stimulus to excitable constitutions.

[We may here direct special attention to *Buxton*, with its natural baths of 81° to 82° Fahr. The elevation is about the same as that of *Schlangenbad*, viz., about 900 feet above sea-level, but *Buxton* is somewhat cooler during summer, and exercises in general a more bracing influence. The fact that a course at *Buxton* saves the journey to the Continent is to many invalids a great advantage, while to others the more complete change and the greater warmth of *Schlangenbad* are preferable.]

Absorption of gouty exudations.

For the absorption of gouty exudations may be recommended, in addition to a course of mineral water-drinking, above all, warm and very warm baths, followed by perspiration in bed, as is the practice at *Teplitz*, *Pfäfers*, *Ragatz*, *Wildbad*, *Warmbrunn*, *Aix la Chapelle*, *Wiesbaden* (*Aix les Bains*), and others. Very little depends on the amount of salt contained in the water; the effect is due to the skilful application of the warm water, and a plentiful amount of salt is only to be taken into consideration as a more powerful irritant to the skin. *Moor-baths* also may be used for this purpose; they irritate the skin to a greater extent, though without over-exciting the nervous and vascular system. There is, therefore, but little choice as to the waters themselves, but between the bathing resorts and their different situations. That *Teplitz* in this respect possesses a high reputation, rests in the abundance and great warmth of its springs, and in the combination it possesses of all the amenities of bath life. According as the general state of health renders a higher

or lower situation desirable, we may recommend Gastein, 3,051 feet above the level of the sea; Pfäfers, 2,130; Ragatz, 1,530; Wildbad, 1,333; Plombières, 1,300; Warmbrunn, 1,083; Aix les Bains, 790; Tüffer, 755; Teplitz, 648; Wiesbaden, Aix la Chapelle, and others, of but slight elevation.

Other Remedies.—For the improvement of the general health, all the methods may be used which are to be recommended in cases of retarded convalescence for lessening the dyscrasia. The internal courses of *Vichy, Bilin, Marienbad, Carlsbad, Tarasp, Franzensbad, Elster*, can only occasionally be supplanted by the pure alkaline and the muriated alkaline springs of *Ems, Neuenahr, &c.* In absorbing exudations, the system of warm baths stands in competition with the courses of waters just named, as well as with the drinking of weaker common salt waters, such as Wiesbaden, Homburg, and the like, the warm being generally preferred; and also with the *cold water system* the *sulphur baths* and *sulphur springs*, the latter especially in cases combined with hyperæmia of the liver, and with *moor-baths*. In severe cases we must as a rule be satisfied with one of the two, either with the course of baths or waters; at any rate, with a strong course of baths no strong external course of waters must be simultaneously carried on, and *vice versa*.

Other
remedies.

5. *Rheumatic Diseases.*—There is no bath which would not be recommended as a remedy for rheumatism, and this disease moreover belongs to those which possess hundreds of popular cures, and to which the artificial and natural remedies of the enthusiast and impostor are applied with especial predilection. Many a champion of quackery has become rich through rheumatism chains and antirheumatic balsams; and among the cases recommended for Hoff's malt-extract and Lampe's cure with simples, rheumatism stands at the head. The word rheumatism, although so familiar to the physician and to the ignorant, does not designate an idea forming a scientific or even practical category for individual cases and groups of cases. Of all that we call rheumatic, nothing but acute rheumatism of the joints presents an actual and exact idea of disease; and everything else bearing this name forms a chaos of differ-

Rheuma-
tism.—
Definition.

ent and partially undefined conditions. In many of these cases, if we urge for a definition, no other common mark exists than that they proceed from cold, and are cured by stimulating the activity of the skin. *Acute rheumatism* is an acute feverish dyscrasia of the blood, produced by cold or by epidemic influences, with a characteristic tendency to inflammation of the serous membranes, especially of the synovial membrane and the pericardium. *Fascial and muscular rheumatism* has nothing in common with *acute* rheumatism but the name; no swelling leads one to infer the existence of any considerable exudation. The transitory and wandering character of the symptoms denotes far rather a passing and partial hyperæmia, and at the most very trifling exudations. The results of investigations are negative, and when the affection fixes itself in certain muscles—for example, in the deltoids—the persistent trophical change shows itself, not in a swelling of the part, but in its atrophy, just like atrophy of the liver in consequence of interstitial inflammation. As muscular rheumatism, moreover, as a rule, proceeds from local cold, and this in a locality corresponding with the part exposed, and as the recurrent affections very often, independently of the chilled part of the skin, affect those muscles which had frequently before been the seat of the affection, we may from all this regard muscular rheumatism as peripheric neuralgia, caused by hyperæmia or by slight inflammatory exudations. *Chronic articular rheumatism* is either a consequence of acute rheumatism, when the absorption of the exudations has not been effected, or it proceeds from local or general cold, without fever, and rarely accompanied with perspiration, more frequently combined with a diminution of the synovia, and generally attended with solid and obstinate exudations around the joints; equally frequently, however, there is no cold to be pointed out as the cause, but a state of cachexia, poverty of blood proceeding from scanty nutrition, scrofulous taint, exhaustion in consequence of metallic poisoning, &c.; and as these cases are in nowise distinguishable as regards symptoms from those produced by cold, there are also cases in which the diagnosis between articular rheuma-

Acute
rheuma-
tism.

Muscular
rheuma-
tism.

Chronic
articular
rheuma-
tism.

tism and gouty exudations is perfectly doubtful, and for this reason the name rheumatic gout has been devised. The idea of *rheumatism of the bowels* cannot be admitted; it refers to cases in which, in consequence of great weakness of the skin, congestion and hyperæmia in the peritoneum and bowels are caused by the influence of temperature, and are manifested by neuralgia, and either constipation or liquid evacuation. Lastly, still less can the term *nervous rheumatism* be admitted in the vague sense of this common name. Sometimes it is applied to the rheumatic affections of so-called nervous people; sometimes to cases of the most different kind, in which neuralgic pains and other hyperæsthesiæ appear as symptoms of diseases of the brain and spinal marrow, of hysteria and diseases of the uterus, peripheric manifestations of central conditions, occasionally called forth and aggravated by all possible causes, and among these also by cold.

Rheumatism of the bowels.

Nervous rheumatism.

The mode of *treatment* must in the first place be guided by the fulfilment of a few causal indications. The cases, as we have mentioned above, are not rare in which affections which are entirely similar to chronic articular rheumatism arise from a state of cachexia, from poverty of blood proceeding from scanty nutrition, from scrofula and metallic poisoning. These causes of course require special measures; this, however, in so far presents no difficulty, as there are sufficient antirheumatic modes of treatment which are also directly effective in counteracting the conditions of cachexia.

Causal indications.

The most frequent and important causal indication is presented by *weakness or atony of the skin*. In slighter cases of muscular rheumatism, the treatment of this indication is sufficient for the entire cure, for the local affection disappears of itself when, by invigoration of the skin, the cause for the constant attacks of cold is removed. Friction with the wet sheet, cold affusions after perspiration produced by packing, river-baths, sea-baths, and the gaseous cooler thermal baths of Rehme and Nauheim are the principal remedies for this purpose, the choice in many cases being wholly left to the inclination, and in others regulated by special individual circumstances. With

Weakness of skin.

regard to these individual conditions, no rules but only examples are to be given. Thus, if all other circumstances concur, the *cold water* system is to be preferred when a languid, full constitution affords most prospect of effect to the violent stimulant of cold, and to the simple diet of a cold water establishment; *sea-bathing*, when feebleness of skin is the symptom of a general deficient state of nutrition throughout the body; and *thermal soot-baths* are to be recommended as a milder remedy in those cases in which the weakness of the skin is so considerable that the remedies of hydrotherapy and even sea-bathing produce a cold on every occasion, and with it the appearances of the disease itself, which is especially the case in the above-mentioned conditions of congestion of the bowels.

Direct
treatment
of muscular
rheumatism.

In severe cases of muscular rheumatism, the treatment of the weakness of skin is not sufficient, but a direct removal of the local hyperæmia is required, or that of the presupposed intramuscular exudations. Courses of water-drinking, especially of alkaline waters, which would be recommended on the assumption of a supposed dyscrasia of the blood, are here utterly without effect. None but those remedies which produce an effect on the skin, and through it to the adjacent muscles, are successful—revulsions, local withdrawal of blood, irritation of the skin, ointment and tincture of iodine, but above all baths, and these, according to circumstances, warm or according to the cold water system. The latter consist principally in exciting perspiration by packing with subsequent application of cold water; they presuppose always an organism capable of reaction, and the advantage derived from them is their simultaneous treatment of the causal indication by counteracting the weakness of skin. That which the cold water system aims at in bathing the invalid in his own perspiration, is the direct object of *warm baths*, and this without the demand of personal reaction. The cooler thermal baths are, however, preferable to the very hot baths, as the former do not relax the skin to the same degree as the latter. These less warm baths include: 1. *All indifferent thermal spas*, so far as the bather is satisfied with a moderate temperature, and the mountain air here also contributes to affect the causal

indication; 2. *Sool-baths*, where the amount of salt increases the stimulation of the skin; 3. *Sulphur-baths* and *moor-baths*, which also more stimulate the skin, though at a lower temperature; 4. The *thermal sool-baths of Rehme and Nauheim*, which combine with the stimulant of salt that of carbonic acid, and by means of the latter element act at a cooler temperature as a strong stimulant to the skin, and at the same time remove its weakness. If, nevertheless, either on account of the obstinacy of the case or on account of the violence of the pain, or from external causes, a course of very warm baths be prescribed, at any rate attention must be paid to the causal indication, and the skin must be additionally strengthened by cold treatment or by sea-baths or thermal sool-baths.

Another causal indication is still to be mentioned, and attention to it will be rewarded by many happy results. No inconsiderable number of the most obstinate cases of fascial and muscular rheumatism are corpulent, but in other respects thoroughly healthy persons. In these cases, frequently, all trials of courses of treatment, cold and warm water systems, sulphur-baths, sool-baths and thermal sool-baths, are entirely useless unless the mass of fat be diminished by consistent diet or by a vigorous course of treatment at Carlsbad (or Marienbad); this probably proceeds from the fact that the fat of the subcutaneous cellular tissue resists the effect of the bath on the skin, and the fat of the muscles impedes absorption and the circulation of the blood. A few months of Banting diet effect in these cases sometimes what years of thermal baths have failed to produce.

Corpulence combined with muscular rheumatism.

Lastly, in *chronic articular rheumatism* the causal indication as regards the weakness of skin must not, it is true, be neglected; but in this case the demand for *absorption* becomes foremost, because the disturbances of the functions too greatly affect the existence of the sufferer. In this case, moderate and milder forms of baths, sool-baths, thermal sool-baths, sulphur-baths, and cooler moderate thermal baths, appear as useless compared with the indispensable effect of warm and very warm baths at *Teplitz, Wiesbaden*, and other places, or compared with

Treatment of chronic articular rheumatism.

the strongly absorbent power of the *cold water system*. The choice between these two opposite modes of treatment, again, depends upon the capability of the sufferer. As, however, in an affection of the joints of any standing and extent, there is in most cases a proportional poverty and exhaustion of the constitution, but a small number are suited to the cold water system, and the greater number require very warm baths. For many delicate invalids the elevated thermal baths ought to be chosen; and where even these make an insupportable demand upon the weakened organism, there are the *moor-baths*, the absorption-promoting effect of which is attended with less excitement, and they also permit a more moderate temperature.

Prognosis.

The prognosis of chronic articular rheumatism is somewhat better than that of gouty exudations; yet it is still bad enough to demand caution as regards the raising hope of the sufferer, and to invite careful study of the ordinary remedies and modes of treatment. It is, however, especially to be guarded against expecting and promising a marked result from any bath treatment in cases of so-called callosities (*Schwüelen*). [While corroborating the author's statement, we may allude to the fact that some of these so-called rheumatic callosities are of specific nature. We have seen rapid effect from large doses of iodide of potassium, after repeated unsuccessful balneo-therapeutical trials. Our attention was first directed to this fact by Mr. J. Hutchinson.] We would here again¹ also draw attention to the peculiar nature of the so-called arthritis deformans, and the very bad prognosis of this disease, especially as regards the effect of baths.

Exudations.

6. *Exudations not of a Rheumatic and Gouty Character*.—From the fundamental character of the effect of warm baths, and from the analogy of the experiences with regard to the thermal treatment of gouty and rheumatic exudations, the practitioner may derive a clue as to the indications of baths in many other exudations; and in the following statements we only purpose to note the results of clinical empiricism in a few specially important and frequent cases.

¹ See p. 116.

Scrofulous exudations in glands, bones, and subcutaneous tissues require generally energetic treatment, which will be further mentioned in speaking of the *sool-baths*. Scrofulous exudations.

Traumatic exudations—for example, excessive or falsely situated callous formation after fractures, exudative ankylosis after fractures, luxations or contusions, and induration of the cellular tissue after traumatic affections and firm bandaging—require the strongly absorbent treatment of the thermal or cold water system, according to the general principles of this alternative in its suitability to the individual conditions of the case, and often the co-operation of local forms of baths, bandagings, douches, and the like. Traumatic exudations.

Ovarian tumours of the most different kind appear in special balneological literature, and in various manuals, as matters for treatment by means of baths and waters, especially of alkaline waters, saline waters with or without iodine, and sool-baths. Truth, however, reduces the matter to very scanty results. The hyperæmia and inflammation of the ovaries, especially of one of them, which accompanies chronic metritis and various anomalies of menstruation, and in many women occurs at every menstruation, disappears wholly or partially under the influence of warm baths or cold hip-baths, or courses of waters that promote absorption, among which those of *Carlsbad* held the pre-eminence before iodine waters came into fashion. Courses of baths, moreover, according to the general principles laid down, may amend the general health; this is, however, all that can be said, and all balneotherapeutic indications, with regard to ovarian dropsy, fibrous and colloid swellings, and cysts, are to be classed as curiosities of science. Scanzoni warns against the use of hot baths in ovarian tumours, on account of the danger of congestion of abdominal organs. Ovarian tumours.

Chronic Metritis.—Chronic infarction is, according to the most trustworthy gynecologists, but rarely cured; this is more frequently the case with inflammation of the neck of the womb, and catarrh of the uterine mucous membrane. Apart from the purifying and quieting effect of warm injections and douches, and the tonic effect of cold ones, courses of baths and waters belong to the generally used Metritis.

and tolerably effective remedies. Few cases are suited for a violent course of *cold water treatment*, on account of the irritable weakness which, for the most part, accompanies the disease, if it be of any standing; but they are better adapted to *warm* baths, and courses of waters with soda, salt, and Carlsbad springs. Besides the object of producing a revulsion to the skin, and promoting absorption and circulation in the pelvic organs, there exist in most cases indications as regards the general health, such as hysterical symptoms, spinal irritation, and anæmia, which must be considered according to the rules laid down for them. A *course of chalybeate waters*, for the removal of the anæmia accompanying chronic metritis, is generally contra-indicated.¹ Fibroids of the womb are not amenable to hydrotherapeutic treatment.

Dropsy.

Dropsy, in various forms and from various causes, affords one of the most important indications for diaphoretic treatment by means of hot baths. Great caution, however, is necessary in the treatment and in the selection of the cases. Such patients are, besides, rarely sent to spas, but are usually attended at home or in hospitals. Œdema depending on local causes, as well as exudations in the cellular tissue in the vicinity of veins, often give way under the influence of sool-baths and thermal sool-baths.

Mammitis.

Tumours of the breast, if they consist only in the intumescence of the mammary gland, or in the hypertrophy of the connective tissue, are occasionally, though rarely, removed or diminished by a course of absorbent baths and waters.

Chronic Orchitis.—Usually only the tubercular enlargement of the testicles becomes the subject of balneotherapeutic treatment. The prognosis is not generally favourable. Warmed sool-baths, or the thermal saline baths, may occasionally be useful.

Enlargement of the tonsils.

Hypertrophy of the tonsils is in no case to be removed by general, but only by local remedies, especially by caustics and the knife.²

¹ See the treatment with iron in the third book.

² The tendency to constantly recurring sore throats with enlargement of the tonsils in young people is diminished, and frequently cured, by hydro-

7. *Syphilis*.—The value of the *cold water cure* in Syphilis. syphilis has been discussed (p. 73); and instead of the milder forms of the cold water-cure, courses of warm baths may advantageously be used, according to the general principles guiding the choice between the cold and warm water-cures; and here the selection may be made according to individual conditions between the indifferent thermal spas, especially those in elevated situations, ordinary and thermal sool-baths, and sulphur-baths. Hebra and many other practitioners do not attribute, as regards syphilis, any special virtue to the presence of sulphur in the sulphur-baths, which owe their specific reputation to the general belief in the purifying properties of sulphur, and further, to their influence in combating mercurial poisoning. Other simple thermal spas have probably the same effect. In most cases of inveterate syphilis the invalid ought to be treated as a person with imperfect power of reaction, requiring careful management—the milder thermal methods, warm clothing, climatic change, mountain air. Sulphur-baths.

The discolorations left by *syphilitic exanthemata* are more readily removed by the *thermal* method, which accelerates the renewal of the epidermis.

Latent syphilis is alleged to be rendered manifest by the use of *sulphur-baths*; but there is probably no further foundation for this supposed effect than the fact that whatever lowers the general health of a person affected with syphilis, is apt to arouse the latent disease, and that the injudicious or exaggerated use of hot baths may have the same effect. Latent syphilis.

8. *Disturbances of the Abdominal Functions*.—Excitement of the activity of the skin, contripetal stimulation of the nervous system, increased tissue-change, are the points here to be taken into consideration. *Courses of waters* will be mentioned in the third book; the importance of the *cold water system* has been already entered into, and the alternative between *warm* and *cold baths* Abdominal disturbances.

therapeutic processes, commenced in an establishment and continued at home, by prolonged open air exercise, by breathing through the nose with closed lips, and by all influences combating the tendency to catch cold.—Ed.

has been also pointed out. As in many cases the course of waters is the more important part, and the effect of the baths is principally produced by the warm water, the choice is for the most part directed to the springs for drinking, at which bathing arrangements are always provided.

Chronic
exanthemata.

9. *Chronic Exanthemata*.—These cases have been discussed fully and sufficiently at page 111 *et seq.* Arsenic taken internally, local treatment with a small number of empirically tested remedies, and the cold water system, are the principal remedies, compared with which warm baths only possess the importance of being very frequently necessary adjuncts. We have only to repeat that (1) in eczema the skin is generally too irritable to endure soot-baths; that (2) we do not deny the occasional success of various baths, among others, of sulphur-baths; but that (3) these occasional successes, though in former times they were allowed to establish theories, are now, since Hebra's system has laid down another rule for the cure of obstinate exanthemata, utterly lost sight of when compared with the immense success of this special treatment.

Paralyses.

10. *Paralyses*.—Warm baths form the most usual and important remedy against almost all kinds of paralysis capable of cure or improvement. There are so many forms of paralysis, essentially different also as regards treatment, that a distribution of the more important cases into twenty divisions appears barely sufficient. For this reason, it is advisable to condense into one section all that is necessary for our practical purpose.

Classification.

The division of paralyses, according to their general causes, into rheumatic, gouty, syphilitic, and saturnine paralyses, as has been laid down in compendiums for the sake of establishing the indications, is of little practical importance, because the direct treatment of the paralysis itself is more essential than the causal indication, on account of the tendency of the affected nervous fibre to irremediable trophical changes. Practical importance, both as regards prognosis and treatment, belongs to only two causal alternatives, namely, the difference between *dynamic* and *organic paralyses*, and that between *central*

and *peripheric paralyses*. *Dynamic* we call those paralyses in which the existence of exudations, extravasations, and perceptible trophical changes in the substance of the nerves or their surroundings, is neither made perceptible by the symptoms and progress of the malady, nor is as yet proved by anatomical investigation; such as paralytic weakness from anæmia, exhaustion of the spinal marrow after typhus and other acute illnesses, hysterical paralysis, reflex paralysis, paralysis after spinal concussion, and most cases of impotence. *Organic*, on the contrary, is the paralysis when the substance of the nerves is injured by any trophical change, or by pressure on their surrounding parts; and only in this sense is there any practical difference between central and peripheric paralysis. *Peripheric paralyses* are those proceeding from injuries or pressure on the nerves, rheumatic paralysis of the facial nerve, paralysis in consequence of gouty exudations or syphilitic enlargements of the bones, which produce a pressure on the peripheric nervous fibres. *Central paralyses* are those following apoplexy of the brain and spinal marrow, softening and sclerosis in these central organs, gouty and syphilitic enlargement of the bone in the head and spine, meningitis spinalis, tabes dorsalis; and also paraplegia after fractures and luxations of the vertebræ. Paralysis of the bladder can be both peripheric and central; in the former case, however, the substance of the muscles of the bladder seems rather to be the part affected than the nerves.

The central or peripheric seat of the paralysis has scarcely any influence upon the general indication of treatment, as the remedies applied are about the same; but the character of the paralysis involves an important therapeutic alternative. Dynamic paralyses present other indications than organic paralyses, such as exudations, tabes, apoplexy; and although the remedies for both cases often concur, they are employed in each case with a different intention, and consequently often in another manner.

a. *Dynamic Paralysis.*Paralysis
from
anæmia.

(1.) *Paralysis from Anæmia.*—We are not acquainted with any cases of real paralysis from mere anæmia. A high degree of anæmia produces, it is true, a *paralytic weakness*, which, however, is still essentially different from even the milder degree of paralysis, namely, paresis; it is general and not, as all real paralysis, limited to a certain range of nerves, and it lacks all accompanying anæsthesia or hyperæsthesia. All retarded convalescence presents at the outset an example of this paralytic weakness. Of the more distinct cases of this anæmic paralysis there are, however, two to be especially mentioned. 1. Weakness often approaches paralysis in women who have suffered great loss of blood in childbed, or in consequence of fibroids and polypus of the uterus. 2. There are some cases of chlorosis in young girls who are exposed to a northern climate, which is especially dangerous for anæmic constitutions, and who suffer at the same time from very copious fluor albus; these cases (see page 57) are principally to be found in Russia; cases of chlorosis with such emaciation and weakness that the physician is sometimes tempted to confound them with progressive muscular atrophy. Generally, such invalids are overpowered by a course of iron, by sea-air and sea-bathing, and they lack all the reactionary power required for the cold water system. Nothing but the gentlest stimulating remedies can be borne and will be found beneficial; quiet enjoyment of mountain air, moderate gasless thermal baths of a temperature to be regulated according to individual requirements (page 127); in very atonic cases the thermal sool-baths of Rehme and Nauheim, and, above all, change of climate and avoidance of a northern winter.

Paralysis
from ex-
haustion.

(2.) *Paralysis proceeding from Exhaustion of the Spinal Marrow after Acute Illness.*—After typhus, and especially typhoid fever, influenza, and other acute illnesses, also after very hard and long continued labour in child-birth, there frequently arises a state of *paralytic weakness*, which in form, it is true, entirely resembles the former, but which does not proceed directly from anæmia, but is caused

by *exhaustion of the spinal marrow*. That this actually is the case, is proved by the absence of well marked anæmia, and the compatibility of the illness with stronger remedies. The weakness of all the muscles is still more evident than in the former case, and approaches still more nearly to paralysis, especially to paraplegia, not because the lower extremities are more weakened than the other groups of muscles, but because they have more weight to carry, and their weakness therefore is particularly apparent. In most cases the natural progress of convalescence in itself removes the paralysis; in severer cases, however, a course of stimulating baths is indicated, and these are borne and prescribed at high degrees of heat. Baths of every kind are available, so long as they contain warm water; indifferent *thermal baths*, *sool-baths*, *sulphur-baths*, and *pine-wood-baths*. Very severe cases, however, or the desire for rapid recovery, call for the carbonic acid thermal baths of Rehme and Nauheim. Chalybeate waters, the cold water system, and sea-bathing are just as much prohibited as in anæmic paralysis.

We must distinguish from these cases of pure paralytic weakness, the specific and local paralysis after typhoid fever, and the exudative spinal meningitis which arises from cold during convalescence after acute illness, and which we shall mention presently in speaking of central organic palsies.

(3.) *Paralysis of the Mind and Will from Exhaustion of the Brain*.—We have intentionally passed over the difficult and much disputed question as to the treatment of disorders of the mind by cold and warm forms of baths, because bathing resorts, as a rule, are not the fitting residence for such invalids: and water-treatment in such cases must be an affair for lunatic asylums and physicians attached to them. On the other hand, however, there are cases in which removal to an asylum is forbidden, while residence at a bathing resort is permissible. Such conditions, for instance, we have seen in officials appointed to posts to which they were unequal. Morbid slowness, without aberration, of ideas, paralysis of will, loss of appetite and sleep, were prominent symptoms, and gaseous thermal

Paralysis
of the
mind and
will from
exhaustion
of the
brain.

of Rehme exercised a restoring influence. Similar conditions are also occasionally observed from mental overwork.

We are firmly convinced that the stimulating effect produced in these cases by the thermal baths at Rehme would be equally well and quickly obtained by other modes of treatment, by the *cold water system*, by Gastein and Wildbad.

(4.) *Hysterical Paralysis* afford in general a good prognosis. They probably depend on spinal irritation, are mostly confined to one extremity, or only to certain groups of muscles, and are often combined with tonic muscular spasms, and often with trembling convulsions; a complication which in other cases renders the prognosis less promising, but which in hysterical paralysis in no wise interferes with recovery,—a plain proof that in this case we have not to do with organic lesions, but with dynamic conditions, or at the most with local fluxions, local hyperæmia and anæmia in the central organs. The courses of treatment stated elsewhere, with the improvement of the general health, usually result in the removal or improvement of the paralysis; and even when they fail in the general effect, are still frequently successful in diminishing the paralysis. According to the stronger or weaker evidence of spinal irritation, *soothing* or *stimulating* modes of treatment have to be chosen; in general it is best to maintain a medium course between two extremes, and moderately warm baths, sool-baths, and thermal sool-baths are to be preferred to the hot and cold systems.

Among auxiliary remedies, the *continuous current*, applied to the corresponding part of the back, often produces a momentary effect; while the induction current, which does not reach the centrum, is in this case only a powerless local stimulant.

(5.) *Paraplegia from Concussion of the Spinal Marrow*.—There are cases on record in which complete paraplegia, with participation of the sphincters and of the sexual power, in consequence of mechanical concussion, has yielded rapidly to a course of hot baths or the constant current.

(6.) *Impotence in Men*.—We here discuss only those cases depending on the nerve-centres, excluding those men-

tioned in No. 5. There appear to be two separate centres of innervation for the sexual functions, the medulla oblongata and the lower part of the spinal marrow. The medulla oblongata seems to form a centre for the psychical as well as for the peripheric stimulus; from this upper centre the stimulus is transmitted to the motor sphere of the lower part of the spinal marrow. In favour of this view are the essentially different cases of impotence. In cervical irritation, such as is frequently caused by masturbation, the secretion of semen is abundant, the sexual desire excessive, the act rather rapid; in impotence without cervical irritation, such as we observe in the natural course of advancing years, or as the effect of excesses, concussions, and trophical changes, paralysing the lower part of the spinal marrow, there is absence or scantiness of seminal secretion, and, if it occur, the muscular action depending on the spinal innervation is wanting.

This distinction leads to a practical difference of treatment. The spinal irritation requires calming influences; tepid baths, followed by the gentle local application of cold, in the shape of sponging, &c., have been found useful. Spas like Schlangenbad, and other indifferent thermal baths, are alone admissible, while the hotter baths of Wiesbaden or Teplitz are often injurious.

The paralysis of the lower sexual portion of the spinal marrow demands, on the contrary, warm and even hot baths, peripheric excitation by the induced, and central stimulation by the constant current, and thermal sool-baths aided by the constant current. Though the prognosis, in this latter form, is on the whole unfavourable, we meet occasionally with an encouraging result from this plan of treatment, while strychnic and chalybeate remedies are useless.

(7.) *Reflex Paralysis*.—Without discussing the correctness of the views of Romberg and Brown-Séquard on this subject, we must acknowledge that there are occasionally cases of paralysis of one or more extremities after acute diseases, with affections of internal organs, as after typhoid fever, cholera, tropical fevers with enlargement of the liver; and that the comparatively favourable prognosis

Reflex
paralysis.

renders the view that these forms of paralysis do not depend on organic changes of the nerve centres, somewhat probable.

The stimulating treatment of the thermal system forms the main point required; *warm* and *very warm baths*, *carbonic acid thermal sool-baths*, are the corresponding remedies. The cold water system, according to the individual case, is not excluded in principle; but the boasted accounts of its *cures* of *reflex paralysis* relate for the most part to cases of spinal irritation and hysterical paralysis.

b. *Organic and Peripheric Paralysis.*

Peripheric
paralyses.

Peripheric paralyses occur but rarely in comparison with central palsies, much more rarely than their constant mention in compendiums would lead one to suppose. The pressure of a swelling or an exudation upon a peripheric nerve must interrupt the conducting power, and the treatment can alone consist in the removal of the cause; after which stimulating remedies, warm and very warm baths, the induction current, and the like, may be indicated. Rheumatic affections of the sheath of the nerves may produce paresis and anæsthesia with or after neuralgia; the treatment then indicated must have in view, besides stimulation, the absorption of impalpable exudations. Not very rarely a rheumatic paralysis of this kind is observed in the brachial plexus, somewhat more rarely in the serratus posticus muscle, but more frequently in the facial nerve.

All these cases are not only of a local nature, but are frequently caused by an entirely local and partial exposure to cold; and as not unusually healthy and vigorous persons are subject to such local colds, it is evident that the strongly stimulating treatment of *cold water* can frequently prove successful. On the whole, however, experience is more in favour of *warm* and *very warm baths*, and in more torpid cases in favour of *sool*, *thermal sool* and *sulphur baths*, and *vapour baths*; but local remedies are frequently indispensable, as iodine, blistering, or the induction current, and this especially in affections of the facial nerve, because in this case the part of the skin affected does not in the bath receive directly the stimulus of heat.

Among the peripheric paralyses, a specially difficult subject is the *paralysis of the bladder*. This, when it is really peripheric, proceeds almost always from organic diseases of the bladder, from chronic catarrh, cancer, enlargement of the prostate gland, or varicose veins; and in these cases it results from fatty atrophy of the muscles of the bladder. When the primary disease is not of long standing, the muscles recover after its removal; if of long duration, little can be done.

Paralysis
of the
bladder.

c. Central Organic Paralyses.

(1.) *Apoplexy of the Brain, Hemiplegic Paralysis.*—

The prognosis and cure of these paralyses may be deduced from the progress of the disease *during the first few weeks*. If in the first three weeks there be no appearance of muscular contraction, we may securely reckon upon perfect recovery, or considerable improvement, which can with suitable management be brought about by nature alone, but may be assisted by a course of slightly stimulating and moderately warm baths, indifferent thermal baths, sool-baths, warm sea-water baths by the seaside, and thermal sool-baths.

Hemi
plegia.

Prognosis.
Slight
cases.

If muscular contractions form, they appear within the first few weeks; they give evidence that an actual state of transudation exists, and that cicatrisation or softening is occurring; and perfectly similar is the progress of cases in which local softening arises in consequence of embolism and thrombosis in the brain. *The prognosis in these cases is bad; contractions are never removed*, either by nature or by art. All the successes boasted of in this respect by balneological literature are only a delusion; the regeneration of a destroyed portion of the brain is a thing of impossibility.

Severe
cases.

Nevertheless, this form of paralysis is an important subject for medical attention. The non-contracted muscles are rarely entirely paralysed; they are frequently only paretic, and are capable of perceptible improvement; but neither cold nor warm baths are sufficient to take the place of the *induction* current, the only efficient remedy for

Treatment.

this purpose; the best prospect in this respect is afforded by those muscles the antagonists of which are not contracted. By the use of baths, and by means of all the influences which are brought to bear in a course of baths, the *general health*, which is usually impaired, can be improved, and for this purpose may be recommended indifferent thermal spas in elevated situations, *thermal sool-baths*, *sea-baths*, and gentle *cold water treatment*, according to the individual circumstances of the case, and especially according to the supposed greater or lesser *inclination to relapses*. It is of especial necessity in such courses of treatment to keep up the spirits; these are almost without exception depressed and effeminately weak. Hope is not patient and joyful, but passionate, vehement, and anxious; and thus the physician is often induced to place a certain prospect of recovery before the sick person, though it is opposed to all possibility. These prognostic errors are of the greatest importance. It is the case, unhappily, in Germany, that the physician is for the most part obliged to palliate the sad truth at the bed of the sick, and even of the dying, although it is more worthy of a human being to meet death with consciousness rather than with false hope. It is, however, certain that many sick people are painfully wronged, when a greater extent of recovery is held out to them than the nature of their malady allows; and this is especially the case with apoplectic patients.

Incon-
siderate
prognosis.

Softening
of the
brain.

(2.) *Softening and Sclerosis of the Brain* are neither capable of cure nor of improvement. To counteract the accompanying symptoms of irritation, soothing baths may be tried; the paralysis resists every remedy.

Spinal
paralysis
in children.

(3.) *Apoplexy of the Spinal Marrow, Spinal Paralysis in Children*.—This form of paralysis, called by others *essential paralysis*, arises in young children, for the most part at the teething period, from feverish congestion of the spinal marrow, affecting in most cases a leg or an arm, but rarely both extremities. Its symptoms accord with those of hemiplegic paralysis, and in many cases its cause may be proved in an apoplectic spot in the spinal marrow. Here, also, frequently, though not constantly, contractions

are formed. On the other hand, the danger of fatty degeneration of the muscles is still more urgent than in cases of hemiplegic paralysis; and to prevent this degeneration is the main task of the treatment. Hence, stimulating treatment must begin very soon, and we must at once silence the fear of producing a fresh attack of apoplexy of the spinal marrow by the use of strong stimulants. This is an error; with the spinal marrow the case is quite otherwise than with the brain, and the author knows of no relapse of the kind, either within his own experience or that of others.

As in brain-apoplexy, so in the spinal paralysis of children, there are a few *slight cases* in which the muscles affected are only paretic; these yield to the application of warm baths, and especially of the gaseous baths of Rehme and Nauheim. Most cases, however, especially those accompanied with contractions, are obstinate, and require beside the above-mentioned course of baths, the simultaneous and indispensable use of the *induced current*, continued and repeated for years. From baths alone no result worth mentioning is to be expected. In most cases nothing more is obtained than the sufficient strengthening of the muscles capable of improvement, to allow a slight use of the extremity by the help of orthopædic contrivances.

(4.) In *Tabes Dorsalis*, experience has established the prognosis so far as to be able to state that most cases progress very slowly, frequently lasting twenty or even thirty years; that a few recent cases have been cured; that many of the more severe are capable of transient amelioration and arrest; but that no positive or long continued case has been cured.

Tabes
dorsalis.
General
prognosis.

The physician is rarely able to follow out a causal *indication* with success, because tabes very rarely proceeds from one cause alone, but almost always from a combination of causes, which, moreover, usually have been too long at work for their removal to be of any essential influence. Among these causes, sexual excesses and the misuse of spirituous liquors are concerned far less than was formerly supposed; colds, intense fatigue, and mechanical injuries only produce the disease when combined with other causes; disturbance of the abdominal circulation

Causal in-
dications.

frequently induces a disposition to tabes, probably on account of congestion in the spinal marrow; direct causes are, however, an excessive use of nicotine and chronic catarrh of the stomach, which if of any long continuance, readily produces either tubercles of the lungs or tabes. The causal indications which result from this, are of course important enough, but they require no detailed statement in this place.

Among the different kinds of tabes there is mentioned an *hysterical form*, which, however, from our abundant experience in the matter, we refer to the hysterical paralysis mentioned at page 150, or to the cases of arthritis deformans of the vertebral column to be discussed under paragraph 9 (p. 161). We have, it is true, seen cases of actual tabes among women, but without such distinct and excessive reflex activity as marks the character of hysteria.

Treatment. The *direct treatment* of tabes has been attempted with such different remedies and such contradictory results, that it is impossible for the present to draw any definite and certain indications from clinical experience. The anatomical changes in different cases vary so much, and the exact relation of these changes to the varying symptoms is, as yet, so imperfectly known, that we cannot wonder to find pathological and therapeutical experience somewhat at variance. Of all the modes of treatment which have been tried, we may mention the following as the more important.

Iron. *Courses of iron*, especially a course of chalybeate springs, were a favourite remedy in former times, and indeed throughout the first half of the present century; because with the idea of pure atrophy there was combined a vague necessity for the 'strengthening of the powers,' and the fulfilment of this necessity was deduced from the general characteristics of the effect of iron. The accumulated observations of recent years have rectified this error; iron, it is found, is not merely without effect, but it is even injurious, inasmuch as it produces irritation which exceeds the power of resistance possessed by the enfeebled spinal marrow.

Cinchona and *quinine* are occasionally useful, while

strychnine is to be rejected. *Cod-liver oil* has no effect on the disease. The occasional results of *iodide of potassium* are probably to be referred to cases of meningeal exudation. *Opium* and *morphia* are dangerous. *Nitrate of silver* may be tried, though the positive results are rare. *Counter-irritation* adds fresh troubles to those already in existence. *Local abstraction of blood* is occasionally useful.

Regarding *electricity*, we may say that the trial is not yet finished. The induction current has been found useless, while the constant current counts among many failures some indubitable successes in early cases, and ought, therefore, to be always tried.

There is scarcely a single thermal bath which has not Baths. been recommended and employed as a remedy for tabes. Warm baths of various temperatures, corresponding with the circumstances of the case, are among the most usual modes of treatment. Recent cases are cured or essentially improved by them; cases of longer standing are temporarily improved, or their advance is checked for a time; some of the symptoms become mitigated, especially neuralgia and sleeplessness, and weakness of the bladder. The results with regard to thermal treatment gained by the author from experience in more than 500 cases of tabes, are briefly as follows.

Very warm baths, as well as the more energetic forms of the *cold water system*, exhaust and over-stimulate most sufferers from the disease; and where they have proved successful, there has probably been a diagnostic confusion of the disease with exudative meningitis. On the other hand, it cannot be denied that gentle *cold friction* has frequently a very beneficial effect upon the general health, as well as upon some of the symptoms of the disease.

Before discussing the rules guiding us in the choice Weakness
of the
spinal
marrow. between the gaseous thermal sool-baths and the indifferent thermal baths, we must draw attention to the fact that *very slight cases* of tabes occur which, it is true, are characterised by a slight degree of real tabetic symptoms, but which, from the change in the symptoms, and from the favourable progress, do not perhaps deserve the name of tabes, but rather the designation of *weakness*

of the spinal marrow. Fatigue from the slightest exertion, and a feeling of weight in the limbs, slight anæsthesia and ataxia after much walking and standing, sometimes accompanied with irritability of the bladder, these are the symptoms of this weakness of the spinal marrow, which is often permanently removed by a short course of thermal baths at Rehme or Gastein or Wildbad; and in these cases the choice is generally free between indifferent thermal baths and Rehme, and we have even occasionally observed good results from simple sool-baths, and friction with the cold wet sheet.

Hæmorrhoidal
tabes.

The same may be said of similar cases in which slight appearances, either from symptoms or ex juvantibus et nocentibus, point to a so-called hæmorrhoidal cause, and to a slight pressure from the congested veins of the spinal marrow. Here also the choice between the baths mentioned seems to be indifferent, presupposing that the course of treatment is assisted by the internal use of water containing a little common salt. If, however, the pressure of the veins be greater, and the symptoms more severe, a stronger effect upon the skin is required from the baths, in order through it to affect the circulation of the blood; and in these cases Rehme and even *sea bathing* are to be preferred on this account. A course of waters also is decidedly efficacious, and the strong sulphur-waters of Weilbach especially deserve the preference, when stagnation in the portal system has produced a permanent hyperæmic enlargement of the liver.

Severe
cases.

In *distinct cases of tabes* all therapeutic experiences are so contradictory, that the establishment of positive rules is not to be thought of. Recovery we have never seen, but improvement and checked advance often. Whether the thermal baths at Rehme will be of any advantage, depends very often on experiment; if the patient feel his limbs stiff and heavy after each bath, we may expect no successful result from Rehme, and we should urge the trial of some indifferent thermal bath; if, however, after each bath there be a general feeling of health and lightness in the limbs, and if this continue during the course of treatment, an improvement frequently sets

in which brings the patient from the wheeled chair to the crutch and stick; and the course of treatment should be discontinued for a time, as soon as a bath begins to fail in producing that immediate favourable result.

The less marked we find the symptoms of irritation, the more we may expect success from thermal sool-baths; the more violently, however, and the more constantly eccentric pains appear, and the more the state of the disease deserves the name of *tabes dolorosa*, the more decidedly are indifferent thermal baths to be preferred. Frequently such sufferers have found alleviation for their pain at Schlangenbad, Gastein, and Wildbad, and have afterwards been able to bear the thermal sool-baths, and thus to attempt an improvement of their paralysis. As regards the choice of the indifferent thermal baths themselves, this should be guided principally by the climate; in summer the higher mountain situation of Wildbad and the lofty position of Gastein are to be preferred, and in spring the soft and fresh climate of Schlangenbad, Warmbrunn, and others. The efficacious element in the thermal sool-baths, besides the powerful stimulus of salt, is *carbonic acid*, which produces a strong centripetal excitement of the brain and spinal marrow. All that has been said of Rehme applies of course to Nauheim, which is similar in every respect.

Alternative
between
Rehme and
indifferent
thermal
baths.

(5.) *Softening of the spinal marrow*, chronic myelitis, and sclerosis are not to be distinguished from each other by the symptoms alone. No cure is to be expected from baths, excepting, perhaps, alleviation of the phenomena of irritation by the indifferent thermal baths.

Softening
of the
spinal
marrow.

(6.) *Meningitis spinalis exudativa*, with its consequent paralysis, presents one of the most important and grateful indications for the use of warm baths, especially for the thermal baths at Rehme, and therefore, we may surmise, for the similar ones at Nauheim. As this disease is often confounded with *tabes*, and has even been called 'acute *tabes*,' and as, moreover, a practical examination of it has proceeded from the abundant experience of the disease afforded at Rehme, it may be as well to enter more closely into its details at the present opportunity. It appears

Meningitis
spinalis.
Progress.

suddenly accompanied with violent fever; it localises itself either in the lumbar portion of the cord or in the medulla oblongata and base of the brain; eccentric pains in the extremities during the febrile period, and painless paralysis of all their muscles after the expiration of this period, but without ataxy, integrity of the sphincters, increase of paralysis for a few weeks or months after the attack, decrease of it after this period, and an appearance of ataxy during convalescence,—these are the characteristics of the disease, to which we have yet to add the absence or only the slightest degree of anæsthesia. In the acute stage of the disease, inflammation is the cause of the symptoms, and in the chronic stage, exudation. No less characteristic than the course of the disease is its etiology; the disease never arises otherwise than after violent cold, and even then only when the body is much lowered by acute or by certain chronic illnesses, after syphilis and repeated courses of mercury, in convalescence after epidemic influenza and acute exanthems, in children especially after measles and scarlet fever, in grown people after small-pox, and in officers especially after violent fatigues in a campaign.¹

Prognosis.
Treatment.

The *prognosis* is unfavourable if, from mistaking the nature of disease, an erroneous treatment with strychnine, nitrate of silver, and the like be entered upon, and the only proper mode of treatment be therefore delayed; if the exudation have gone on for more than six or eight months, it is no longer capable of being fully absorbed. The prognosis, however, is very favourable if the acute stage, in spite of the increasing paralysis at first, be treated with antiphlogistic remedies, namely, with local bleedings, local cold applications, and subsequently with warm baths; when afterwards the symptoms of paralysis are all that is left behind, a steady course of baths is to be commenced, if possible of thermal baths at Rehme and Nauheim, otherwise at any baths most easily attainable. Recent cases in youthful persons may be perfectly cured; in grown people a slight paresis is often left behind. We believe, moreover, that the successful results to which Rehme

¹ See Braun, *Bemerkungen über die Meningitis sp. der Officiere*, *Deutsche Militärärztliches Zeitschr.* i, 3, 4, p. 116, 1872.

owes its reputation, may be looked for also from other modes of treatment, perhaps even from the *cold water system*, if they be only begun sufficiently early, and carried on with method.

If the acute stage of the disease have been neglected or erroneously treated, the exudation continues as well as the paralysis, and these cases have been denominated by some as *tabes secundaria*. The longer a case of this kind has gone on, the less prospect is there of any improvement. Strong absorbing and stimulating methods of treatment are here indicated, very warm baths at Teplitz, Wiesbaden, Rehme, and other places; and also when other circumstances permit it, vigorous courses of cold water treatment, often judiciously combined with the use of iodide of potassium, mercurial ointment, and the like.

*Tabes
secundaria.*

(7.) *Diphtheritic Paralysis* offers in most cases a favourable prognosis. The baths of Rehme, Nauheim, and probably all stimulating warm baths, accelerate recovery.

*Diphtherie
paralysis.*

[We have seen also good effects from sea-bathing and from cold douches.]

(8.) *Paralysis from Pressure*, in consequence of scrofulous or syphilitic vertebral enlargements and gouty exudations. The treatment of such cases cannot content itself with attending only to the causal indication, because the paralysis in itself is an urgent symptom, which, if possible, demands alleviation. Strong courses of warm baths are the principal remedy, and when these increase the symptoms of irritation, mud-baths may be used—a purely empirical fact, which we can confirm from manifold experience, without being able to furnish an interpretation.

*Paralysis
from
pressure.*

(9.) *Arthritis Deformans of the Vertebral Column*.—This form of disease has only very recently become the subject of recognition and observation. The author knows five cases, two of men and three of women, the disease in the latter combined with such etiological circumstances and such complications that it had been called hysterical tabes (see page 156). In every case there was a degree of ankylosis of the vertebral column, though not to the same extent in the different cases, and in the three severer cases, combined with paralysis of the lower extremities, and paresis

*Arthritis
deformans
of the
vertebral
column.*

of the arms. Two cases were slight, and were only combined with paralytic weakness, but not with paralysis. In two cases, a vigorous course of baths at Rehme produced considerable improvement; one case, after these baths had proved ineffectual, improved naturally in the course of time.

(10.) *Typhoid Paralysis*, to be distinguished from the paralytic weakness occurring after typhoid fever, is a specific form of disease, arising during typhoid fever, or shortly after its termination; at first assuming the symptoms of general paralytic weakness, and afterwards, when this has left all the other muscles, remaining as a distinct paralysis of the musculi tibialis anticus, peronæus longus, and extensor digitorum. Sufferers from this disease may be recognised by their rattling gait, resembling that of spinal paralysis in children; and, in common with this paralysis also, the muscles mentioned, if not stimulated in time by the induced current, pass beyond recovery into fatty degeneration. The author has only once seen the upper extremities affected, and here likewise the extensor muscles. The prognosis is not quite so favourable as in exudative meningitis; complete recoveries are rare, but considerable improvements are very frequent. It is sad that these sufferers are still often over-stimulated with strychnine. Thermal baths at Rehme or Nauheim, *moor-baths*, or any *warm baths* whatever, combined with steady Faradisation of the muscles threatened with fatty atrophy, are alone able to preserve the sufferer from that crippled condition which is the result of most cases of spinal lameness in children.

(11.) A peculiar and apparently rare form of a general paralytic affection has been observed by the author in six cases. In the course of a few weeks, without pyrexia and without eccentric or central pains, all the extremities became affected; the lower with general paralytic weakness in all the muscles, while in the upper the extensors were specially seized, and particularly the triceps and the extensors of the hand and fingers; the masseters participated, and in two cases also the muscles corresponding to the third nerve. Remarkable was the occurrence of rapid oscillations of power in the course of the same day; the possession of almost perfect strength, varying with

almost complete loss of power. Speech, the movements of the tongue, the sphincters, the sexual power, and the range of the pneumogastric nerve were unaffected; the emotional sphere was rather sensitive. In two cases there was marked vertigo.

The termination of the affection was in all cases favourable; recovery having occurred in the course of a year under the influence of the stimulating baths of Rehme, assisted by the use of the constant current applied to the upper part of the neck.

The author attributes this complex of symptoms to some slight and transitory affection of the medulla oblongata.

In three out of the six cases only some injury to the neck was traceable as a possible cause.

The author promises a fuller account in a future work on diseases of the spinal marrow.

11. *Hyperæsthesia and Convulsive Forms of Disease.*

Under this head we consider conditions produced by very different causes, and for the most part symptoms of brain and spinal disease. Purely peripheric cases of neuralgia demand, like peripheric paralysis, attention to the casual indications. Prurigo has been mentioned among the chronic exanthemata. A few conditions, however, still deserve special mention.

(1.) *Paralysis Agitans*.—Prognosis thoroughly bad. Only a few isolated cases of improvement through the use of warm baths, cold spongings, and the constant current.

Paralysis
agitans.

The trembling of drunkards, generally proceeding from a slight thickening of the pia mater, has been occasionally essentially diminished by warm baths, sea-baths, and thermal sool-baths, if the amount of alcohol taken is limited.

(2.) *Chorea*.—Warm baths have been an usual remedy from a very remote period, also cold affusions (shower baths), river-baths, and sea-baths. Experiences are very contradictory. Individual circumstances must decide, and rules cannot be laid down. In general, however, a soothing mode of treatment is to be selected.

Chorea.

... spas are in general to be avoided, ... use of warm and cool baths may in ... autogenous.

Perfect cures are very rare ; the most ... are probably effected by the very warm ... treatment, such as the baths at Teplitz, Wies- ... warm sulphur-baths, vapour and Roman baths, ... the cold water system has also many successful ... to boast of. The prognosis must be made with ... reserve. A sufferer from the disease rarely submits to the most efficacious remedy, namely, a long period of quiet. (See the paragraphs upon diabetes and its complications with sciatica.) Of late, severe cases of sciatica have been cured, very slowly indeed, but permanently, by a weak constant current, with or without the help of baths, especially of thermal sool baths ; the weakness of the current seems, however, to be an indispensable condition.

[We have also observed a neuralgia dorsalis penis, which resisted every remedy excepting perfect rest.]

Facial
neuralgia.

(5.) *Facial Neuralgia (tic douloureux)* is in most cases of central origin, and is then incurable ; cases of a periph-
eric nature are partly of a rheumatic character, partly proceeding from the irritation of decayed teeth. In the former case, antirheumatic courses of baths may be used, and in the latter soothing remedies may be employed ; balneotherapy, however, cannot boast of any important results, because the affection of the fifth nerve belongs to those complaints which, after long standing, become inde-
pendent of their primary cause. Less importance is to be placed on bath treatment than upon the use of arsenic ; whether subcutaneous injection of morphia can be more than a palliative remedy, has not been yet ascertained.

D. INDIFFERENT THERMAL BATHS.

Indifferent
thermal
springs.

As in the above remarks the whole range of the efficacy of warm baths, as such, has been pretty thoroughly sketched, with the omission of those scrofulous conditions which will be more accurately entered into when we come to the subject of sool-baths, it only remains for us in

this first book to enumerate and characterise those usual bathing resorts, the springs of which contain no other dynamic influence than that of warm water, and are therefore called indifferent thermal springs. The general indications for the use of these baths are contained in the headings of the section just completed; the choice of them is regulated according to the temperature of the springs, the climate of the locality, the social circumstances, and the usual modes of treatment prevailing at the different bathing resorts. As the amount of gas in these springs is small, and almost null, and the amount of salt is slight and of no importance, the same effect may be obtained by baths artificially heated and established in places of suitable climate; and the natural heat of the springs has no other importance than that, without expense, they furnish great quantities of bath water for a great number of sick people. The mysterious spirit of the springs, so familiar to the imagination in bygone times, arose from the effect of moist heat, climate, and system of treatment.

General
character.

[A great advantage of the thermal spas compared with other establishments in which artificially warmed baths are taken, consists in the fact that, by the large quantities of hot water stored in the bathing establishments of the thermal spas, the passages and bathing-rooms are constantly warmed, and that the tendency to chill to which the body is more liable after the hot bath (through the dilated and congested state of the capillaries) is thus greatly diminished, while in ordinary establishments for cold and hot baths, the rooms and passages are often cold.]

The difference of temperature in the various indifferent thermal springs is not inconsiderable. The two best known and most frequented baths, which in this respect form the limits of the two extremes, also differ chiefly in the frequency of their use, and in the class and range of disease for which they are used. These two are *Schlangenbad* and *Teplitz*, the former the coolest and the latter the warmest of this form of bath; both not very diverse in climatic relations, but antipodes in the extent and range of their application. *Teplitz*, annually visited by thousands, gathering together a number of the severest cases of gout,

Differences
of tem-
perature.

rheumatism, and paralysis, for the recovery of which a strong effect upon the absorption of exudations, and a powerful stimulant of the skin or nervous system is required. *Schlangenbad*, on the other hand, is limited to a much smaller number of invalids and to a smaller range of diseases—to those for the most part requiring a quieting effect upon the nervous system, and the careful stimulation of the sensitive organism.

As regards high temperature, *Gastein* may be placed next to *Teplitz*, and this affinity corresponds also with the similarity of the diseases found there. In *Gastein* also, it is cases of paralysis and gouty and rheumatic exudations which form the principal patients, but with this important difference, that *Gastein* is predominantly prescribed for greatly weakened and lowered individuals, requiring cautious treatment; and the reason for this fact can only lie, from the similarity of all other circumstances, in its climatic conditions. From its high situation (3,315 feet) *Gastein* affords the sufferer an Alpine air, the rarefaction of which facilitates the change of substance, or mitigates the integrant vital stimuli to such a degree that the stronger stimulus of warm baths can be borne more easily. The alternative, therefore, between *Gastein* and *Teplitz* has by experience been thus established, that very warm baths can be borne by excitable individuals with less excitement at *Gastein* than at *Teplitz*; the more sluggish the organism, the more is it suited for *Teplitz*; the more irritable, the more it is adapted for *Gastein*.

The higher the situation, the higher are the bath temperatures allowed for irritable organisms; the lower the situation, the cooler must be the bath selected for such constitutions. The more irritable the sick person, all the more is a lower temperature or higher situation indicated; the more atonic the invalid, the higher the temperature and the lower the situation required: and in mixed cases, where both considerations possess equal importance, there are bathing resorts which keep to the medium in both respects. Upon this principle, from early times the indifferent thermal springs (Wild baths, 'Wildbäder'), called natural baths, are to be arranged

for selection in each individual case; and, moreover, the probable circumstances of weather, as well as the greater or lesser difficulty of the journey, and the social circumstances of the place are to be considered. The following table includes *Leuk*, in spite of its lime, a chemically indifferent element in baths of an ordinary duration, and *Wiesbaden*, which as a very warm bath exhibits all the indications of Teplitz, but which, containing about $\frac{2}{3}$ per cent. of salt, can scarcely be reckoned as a bath among sool baths. Even the sulphur thermal springs could in many cases, where the effect is produced, not by the sulphur, but by the warm water, be included in a tabular statement of the kind. The chemical contents of the true natural baths varies between 0.3 and 3.7 grains in 16 ounces; but Leuk contains 14.6 grains, including 11 grains of sulphuric lime. Free carbonic acid exists in most, but in so slight a quantity that it does not come into consideration as regards the effect. A few contain slight vestiges of sulphuretted hydrogen gas, but this is likewise inessential.

TABLE I.

Arranged according to the temperature of the baths usual at the different bathing places.

	Usual Temperature of the Baths	Elevation
	Fahr.	Feet
Plombières	66.2°—143.6° ¹	1,310
Leukerbad (Loèche-les-Bains)	102.2°—122.0°	4,670
Teplitz	99.5°—108.5°	648
Warmbrunn	104.9°	1,100
Wiesbaden	93.2°—104.0°	323
Gastein	90.5°—104.0°	3,315
Tüffer	95.0°—102.2°	712
Römerbad	100.4°	755
Pfäfers	100.4°	2,115
Ragatz	100.4°	1,510
Wildbad	95.0°	1,323
Neuhaus	95.0°	1,200
Schlangenbad	86.0°—90.5°	900
Bertrich	90.5°	500
Badenweiler	88.0°—90.5°	1,425
Landeck	87.8°—90.5°	1,398
Liebenzell	77.0° and higher	1,113

¹ Temperature of the vapour-bath.

TABLE II.

Arranged according to elevation.

	Elevation Feet	Temperature of the Baths Fahr.
Leukerbad (Loèche-les-Bains)	4,670	102·2°—122°
Gastein	3,316	90·5°—104·0°
Pfäfers	2,116	100·4°
Ragatz	1,570	100·4°
Badenweiler	1,496	86·0°—90·5°
Landeck	1,398	87·8°—90·5°
Wildbad	1,323	95·0°
Plombières	1,310	66·2°—143·6°
Neuhaus	1,200	95·0°
Liebenzell	1,113	77·0° and higher
Warmbrunn	1,100	104·9°
Schlangenbad	900	86° —90·5°
Römerbad	766	100·4°
Tüffer	712	95·0°—102·2°
Teplitz	648	99·5°—108·5°
Bertrich	500	90·5°
Wiesbaden	323	93·2°—104°

[As an appendix to these tables we may add, above all, the warm springs of England, viz. :

Bath, elevation about 100 feet above sea-level, the temperature of the hottest spring being 117° Fahr.

Buxton, with an elevation of nearly 1,000 feet above sea-level, and natural baths of 82° Fahr., and artificially heated of about 93° and 95° Fahr.

Clifton, with springs of 74° Fahr. ; and *Mallow*, now neglected, in Ireland, with waters of 69° Fahr.

Among the continental indifferent thermal baths deserve notice—

Johannisbad, in Bohemia, elevation about 2,000 feet, springs 86° Fahr.

Tobelbad, in Styria, elevation 1,200 feet, springs 77° to 83° Fahr.

Bormio, in Italy, elevation about 4,300 feet, springs 90° to 104°, and higher.

Acqui, in Italy, with springs from 100° to 113°, and even 167° Fahr.

Lucca, in Italy, with springs from 100° to 129° Fahr.

Panticosa, in Spain, elevation about 5,000 feet, springs 77° to 92° Fahr.

Luxeuil, in France, elevation about 1,300 feet, springs from 65° to 133° Fahr.

Néris, in France, elevation about 800 feet, springs from 114° to 125° Fahr.

Many other feebly mineralised thermal baths might be added to those mentioned, as, for instance, almost all the hot sulphur waters, or the weak muriated waters of Baden Baden, some springs at Bagnères de Bigorre, and many others, which in their effects when used as baths scarcely differ from the indifferent thermal springs, while some of those mentioned above, like Wiesbaden, Lucca, Bormio, Néris, find also places in other divisions.]

Teplitz (648 feet), in Bohemia, station on a branch Teplitz.
railway—affording, together with the village of *Schönau*, sufficient arrangements for 4,000 daily baths—is one of the most frequented baths in Europe. The neighbourhood is agreeable and rich in vegetation. The climate is, it is true, not rough, but it is also not protected from violent changes, especially in the evening; hence a careful guarding against cold is necessary. The prevailing mode of treatment is in favour of very warm baths up to 105·8° to 109·4 Fahr. (41° and 43° Cent.), and each bath is followed for the most part by one or two hours of gentle perspiration in bed. In this lie the advantages and disadvantages of the system; the advantages as regards the strongly stimulating effect, and the disadvantages as regards cases of great irritability or invalids requiring gentle management, and where a certain weakness of skin causes an inclination to cold. Accordingly, it has recently been attempted to divide the two principal effects produced by warm baths, as the individual case requires, and to give very warm baths to sluggish temperaments, and moderately warm ones to excitable persons, and not to shorten the nightly rest needed by the latter for the sake of the early morning baths. After very warm thermal springs, the increased weakness of the skin frequently renders a subsequent course

of sea baths, thermal sool baths, &c., indispensable. As for the rest, we can dispense with a repetition of the different indications which we have given in connection with the therapeutic value of warm baths. We have only to observe that recently an establishment has been formed for moor-baths.

The temperature of the different springs varies from 76° to 120° Fahr.

[Physicians: Drs. Baumeister, Delhass, Eberle, Ficker, Heller, Hirsch, Karuim, Richter, Seiche.]

Plombières.

Plombières, in the department of the Vosges, situated in a deep and narrow valley at a height of 1,310 feet, is the French Teplitz.

The springs are less mineralised than any other indifferent waters, and are almost like rain-water, only that they are perfectly clear. The baths are given at similar high temperatures as usual at Teplitz, but in most cases they are continued for some hours; and the cases which appear here most frequently are much the same as at Teplitz and Gastein. The water is moreover drunk, and is especially famous in chronic catarrh of the stomach and in gastralgia; to the bath and the surrounding circumstances, however, the principal effect may be ascribed. (Drs. Bloch, Grillot, Léclerc, Lietard, Türck, Verjon.)

Leukerbad.

Leukerbad (Loèche), in the Canton Wallis, 4,670 feet above the sea, at the foot of the Gemmi Pass, surrounded by high mountains, is reached by railway from Geneva, with the exception of a road journey of three hours; and it is very remarkable from the mode of treatment pursued there. The water of the warm springs of a temperature between 102·2° and 122° Fahr. (39° and 50° Cent.), contains in sixteen ounces about 10½ grains of sulphate of lime, 2½ grains of sulphate of magnesia, and 1 grain of other salts, besides a slight trace of free carbonic acid. Taken internally it is not very easy of digestion, on account of the sulphate of lime in it; as a bath, we reckon it among the indifferent thermal springs, because the sulphate of lime is neither capable of being absorbed, nor can it be regarded in the existing quantity as a special stimulant to the skin, with the exception of its effect on the irritated skin when partly

devoid of epidermis in cases of psoriasis, eczema, and the like. The method of treatment is at present considerably varied according to the individuality of the case, but on an average twenty-five days are reckoned for a course, during which period the baths are taken once or twice daily, or every other day. The duration of the bath is gradually extended from half-an-hour up to five and eight hours, distributed over the forenoon and afternoon, and after eight or twelve days they are diminished in the same proportion. Gentlemen and ladies—for the most part Swiss and French—bathe together in reservoirs adapted for about twenty persons, beguiling the time with conversation, reading, taking luncheon, and playing dominoes on floating boards. The bathers, attired in woollen mantles and capes, in this manner avoid the ennui otherwise unavoidable. The diseases which are treated in this manner are gouty and rheumatic exudations, scrofula, and above all, chronic exanthemata, psoriasis, eczema, and prurigo. As regards the latter diseases, it is certainly probable that such continuous maceration of the skin may have a considerable effect upon them, and we would refer to Hebra's statement as to the effect of long continued baths. In general, however, it appears from the treatment at Leukerbad, that long-continued baths of blood-heat are to be borne by many people, and that with advantage, if the action of the vital functions be facilitated by the very high situation of the bathing resort. On the other hand, the author is also acquainted with cases in which the extreme mode of treatment pursued at Leukerbad has done great and lasting injury in tabes, meningitic paralysis, and such like diseases.

The effect of such treatment upon scrofulous, rheumatic, and gouty exudations, i.e., upon conditions of disease in which a higher degree of the exciting effect of indifferent baths is indicated, is easily explicable, and the influence of the high situation may essentially contribute to the ability of enduring the powerful stimulation. The fame of the bath in chronic skin-diseases seems, however, still subject to some doubt. From Hebra's experience regarding the success to be obtained by prolonged baths in obstinate cases, we are led to think that the course of treatment

Effect of
the Leuk
baths on
skin
diseases.

must be much longer than that usually allotted to a bathing course, if any permanent effect is to be obtained. Many atonic ulcers of the foot, especially with callous edges, and many scaly forms of chronic skin diseases are, as stated, especially accessible to the good influence of permanent baths, and from experiences of this kind the mode of treatment pursued at Leuk probably originated. (Drs. Bövin, Brunner, Grillet, Mengis, senr. and junr.)

Bormio.

[*Bormio*, about 4,300 feet above sea level, is beautifully situated at the top of the Valtellin in Upper Italy, at the foot of the Stelvio pass. The climate is rather changeable; the days are in summer often hot, the nights cool. The baths are given at temperatures varying from about 95° to 104° Fahr. Cases of chronic rheumatism, with some anæmia, are often benefited as well by the baths as by the high situation. The new hotel affords good accommodation during the season, which extends from May till September.]

Pfäfers
and
Ragatz.

Pfäfers and *Ragatz*, in the Canton St Gall, the latter a station on the railway leading from Rorschach to Chur, and the former about an hour distant from it. The thermal springs are thoroughly indifferent in their nature; in the baths at *Pfäfers* they have a temperature of 100·4° Fahr. (38·0° Cent.), and at *Ragatz*, whither the *Pfäfers* spring is carried, not quite 96° Fahr. (35·5° Cent.). *Pfäfers* lies in a narrow ravine, 2,130 feet above the sea, and *Ragatz* in a bright and broad valley, 1,570 feet above the sea. Both places together, therefore, to a certain extent, combine the two opposites which must be taken into consideration with regard to indifferent thermal baths, namely, higher situation with warmer baths, and a somewhat lower situation with moderately warm baths. Both are adapted, like *Gastein*, especially to sensitive constitutions requiring careful management, and particularly to individuals to whom the enjoyment of grand mountain nature may prove of psychical influence in the treatment. The water flows continuously through the bathing tubs, and thus maintains, in the bath as well as in the bath-rooms, an equal temperature. The duration of the bath is limited generally to an hour, since the method,

formerly in vogue here, of permanent baths has been given up. [The usefulness of Ragatz is much enhanced by the excellent arrangement of the new baths, including a swimming bath, in immediate connection with the well-managed Hôtel Quellhof. Season, from May till September, the first and last months being not much used, and therefore well adapted for those requiring special attention and a quiet life. Dr. Jaeger, the intelligent physician at Ragatz, has repeatedly directed the editor's attention to this fact.] (Dr. Dorman at Pfäfers, Drs. Jaeger and Kaiser at Ragatz.)

Gastein, thirteen hours from Salzburg, with which it Gastein. is connected by a good road, situated in a narrow valley, 3,315 feet above sea-level, and surrounded by grand and solemn mountainous nature, is, with Wildbad, the main representative in Germany of indifferent natural baths. The climatic circumstances of the place are so far unfavourable, as the months of June, July, and August exhibit almost sixty per cent. of rainy days; nevertheless, here more than elsewhere the influence of the mountainous climate is felt, irritable and weak constitutions are soothed and refreshed, and warm baths are rendered endurable in individuals upon whom, in a low situation, they would have an over-stimulating effect; the rainy days, moreover, are seldom entirely damp, and the rain lasts for the most part only a few hours. Great heat seldom occurs; the highest temperature observed is 86° Fahr. At the same time, rapid and violent depression of temperature is not frequent, and the variations in the barometer are moderate. The social life of the place, both from the majestic character of the scenery and also from the numbers of very great invalids, has assumed in time a serious character which tends to produce a certain evenness in the existence of over-excited and irritable constitutions. The water of the different springs is very clear and soft; in the springs 96·8° to 114·8° Fahr., in the baths generally 95° to 99·5° Fahr., and occasionally 86° to 95° Fahr. The duration of the bath varies now, according to the individuality of the case, from ten minutes to an hour.

Various
apprecia-
tion of
Gastein.

Widely spread as is the reputation of Gastein, its value differs greatly; and in spite of many successes, its failures interfere with its appreciation on the part of some physicians. In some cases an unfavourable summer is the cause of imperfect success; in other cases the irritation caused by the thermal influences of the baths is too great, and occasionally we can learn this in individual cases only by the trial.

General
indica-
tions for
Gastein.

Thus, in some cases, Gastein competes successfully, in others unsuccessfully, with other modes of treatment, such as Teplitz, Schlangenbad, sea-baths, Rehme, and the cold water system. In cases of paralysis especially, and particularly in *tabes dorsalis*, the most contradictory experiences have been furnished; and although the amount of greater or lesser irritability has been shown by us (see page 158) to be the determining point in the selection between Gastein and Rehme in cases of *tabes*, yet the difference in the anatomical conditions in different cases must teach us that, in every case of *tabes*, the prognosis and indications can only be rendered correct by therapeutic experience. Generally speaking, Gastein combines the indications of Teplitz, and those of the milder thermal modes of treatment. For cases of *rheumatic* and *gouty exudations*, and for *atonic paralytic conditions*, there are the very warm baths, as at Teplitz; and the choice between the two depends on the consideration of their climatic and social circumstances and the convenience of the journey: the more any over-excitement from very warm baths is to be feared, the more will Gastein or other elevated indifferent thermal baths be preferred to Teplitz for a vigorous thermal course of treatment; and this is especially the case in those conditions where the quieting and not the stimulating effect of warm baths is required, as in *tabes dolorosa*, *hysteria*, *hypochondriasis*, and the like. The great reputation which Gastein enjoys with regard to *impotence* requires some explanation. Where the impotence depends on over-excitability of the medulla oblongata and cervical portion of the chord from masturbation, the quieting influence of the thermal method may be occasionally successful; where it is a phenomenon of

paralytic affection of the lower portion of the chord, the effect of Gastein is very doubtful. (Drs. Bunzel, von Haerdtl, von Hoenigsberg, Plommer, Pröll.)

An hour from Wildbad Gastein, and 500 feet lower, lies

Hofgastein, whither the springs from the former place are carried and are used at 95° Fahr. (35° Cent.). The situation is more open, but less picturesque than that of Wildbad Gastein, and the bath was chiefly established for the accommodation of the increasing visitors. Hofgastein.

Wildbad, in the Würtemberg Black Forest, 1,330 feet above the level of the sea, situated in a beautiful but somewhat narrow valley, rich in vegetation, is one of the best known indifferent thermal baths in Germany, and from its excellent arrangements has become a fashionable bath, in spite of the somewhat variable climate; a matter, however, which must be taken into the bargain in every elevated thermal bath, and which, it seems, does not interfere with the beneficial influence of the mountain climate. The baths vary between 93·2° and 102·2° Fahr. (34° and 39° Cent.), and are most soothing and refreshing. The same may be said of Wildbad as of Gastein, only that in the latter place the higher situation, the grander scale of the mountainous scenery, and the more quiet and serious life, must be taken into consideration; as well as the fact that Wildbad is accessible by rail, and that there are good arrangements for conveying the invalid from the station to the comfortable hotels. In such an old bathing resort as Wildbad is, certain indications have naturally obtained currency, especially in paralytic cases: the section upon thermal treatment furnishes the material for modifying such one-sided notions connected with the name of a bath, and refers to the dynamics of the general group which the special name represents. (Drs. von Burkhardt, Haussmann, senior and junior, Renz, and Schönleber.) Wildbad.

Schlangenbad—900 feet above the sea, situated in a lovely valley of the Taunus, with a mild, fresh, and equable climate and rich vegetation, at a short distance from Wiesbaden and Schwalbach—is one of the places Schlangenbad.

best suited for the mild, soothing, and refreshing effect of thermal treatment. The springs are clear and soft, and have a temperature of 81.5° to 86° Fahr., which is increased in the baths to 87.8° to 92.3° Fahr. The arrangements are, in every respect, excellent, and the life is quiet. The surrounding wood offers ample opportunity for open-air life during the summer months, and we know of no thermal bathing resort which produces such a calming and at the same time refreshing effect upon the invalid requiring gentle management, as Schlangenbad. All that we have said at page 159, as to the alternative between Rehme and Gastein, applies frequently, in a similar manner, to Schlangenbad; and in many cases, when we have wished to mitigate the suffering in *tuberculosis*, before exposing the invalid to the stimulant of our thermal soot baths, the nearer and climatically safer Taunus bath has effected all that we should otherwise have expected from the remote and often rainy Gastein. Schlangenbad is a small bathing resort, and will always remain such, on account of the quantity of its springs and the form of its valley; but this is really one of its advantages for nervously excitable natures. (Drs. Baumann, Bertrand, and Wolf.)

Buxton.

[Buxton, about 1,000 feet above sea level, is situated at the north-western side of Derbyshire, near the margin of an extensive range of mountain limestone. The temperature of the water is 82° Fahr., and the quantity of solids contained in it, according to Dr. Lyon Playfair's analysis, scarcely amounts to 2 grains in 16 ounces, while the gas obtained from it consists of almost ninety-nine parts of nitrogen, and rather more than one of carbonic acid, with only a trace of oxygen. The water is used internally, but principally for bathing, as well at the natural temperature as warmed to about 93° and 96° Fahr. The time for staying in the *natural* bath (82° Fahr.) is, according to Dr. Robertson, rarely extended beyond five minutes, and the hot bath— 93° to 96° —rarely beyond fifteen minutes. Buxton offers some points of resemblance with Schlangenbad; but the former is cooler in summer, and the climate is decidedly more bracing. I have seen

great benefit from courses at Buxton in cases of atonic gout, and the use of foreign mineral waters may often be advantageously combined with the baths at Buxton. The season extends from April to November.] (Dr. Bennet, Mr. Dickson, Mr. Flint, Dr. Robertson, Mr. Shipton, Mr. Turner, and other medical men practising at Buxton.)

Warmbrunn, in the Hirschberg Valley, on the northern declivity of the Riesengebirge, 1,100 feet above the level of the sea, an old-established and much-frequented bath, with good arrangements. The climate is fresh, and sharp changes of temperature are frequent. The springs are $96\cdot8^{\circ}$ to 104° Fahr. ($36\text{--}40^{\circ}$ Cent.) warm, and are used for the baths at $87\cdot8^{\circ}$ to $100\cdot4^{\circ}$ Fahr. ($31\text{--}38^{\circ}$ Cent.), and in many cases even at 104° Fahr. (40° Cent.). They are indifferent thermal springs, though in former times they were erroneously reckoned among the *sulphur thermal springs*, because they somewhat smell and taste of sulphuretted hydrogen gas, without, however, containing any ponderable amount of this element. The scarcely measurable amount of carbonic acid contained in them is also quite irrelevant of any effect. (Drs. Herzog, Höhne, Lindemann, and Luchs.)

Warm-
brunn.

Landeck, in the Silesian county of Glatz, 1,400 feet above the sea, situated in a mountainous district, was formerly also reckoned among the sulphur-baths. The springs, however, contain so little sulphuretted hydrogen, that, with their otherwise slight amount of salt, they must be numbered among the indifferent thermal springs. Their temperature amounts to $66\cdot2^{\circ}$ to $84\cdot2^{\circ}$ Fahr. ($19\text{--}29^{\circ}$ Cent.), and they are warmed for bath use. Generally speaking, the fresh but rough climate of Landeck is recommended for the application of a moderately stimulating degree of heat in those constitutions which require animation rather than great care, and are not afflicted with too great a weakness of skin. (Drs. Adamezik, Horwitz, Joseph, Langner, and Wehse.)

Landeck.

Römerbad, near Cilli, in Styria, situated on the Austrian southern railway, in a wide valley, at a height of 755 feet above the sea, not far from Tüffer, on the

Römer-
bad.

railway station of the same name, has a soft and fresh climate devoid of sharp transitions. The baths vary in temperature between 93.2° and 98.6° Fahr. (34° and 37° Cent.). The climatic conditions are about the same as those of Schlangenbad, but the life is somewhat more gay. Like Schlangenbad, Römerbad is especially recommended for hysteria and chronic diseases of the uterus, but it also, to some extent, fulfils the indications afforded by Teplitz and Gastein, especially in cases of paralysis and exudations, when baths of blood-heat are sufficient. (Drs. Burgel and Folwarczny.)

Tüffer.

Tüffer (Franz-Josephsbad), near station Markt Tüffer, 712 feet above the sea, with climatic conditions equally favourable with those of Römerbad. A spring of 100.4° Fahr. (38° Cent.) is used for swimming baths; two others of 95° and 99.4° Fahr. (35 and 37.5° Cent.) are employed for separate baths. (Dr. Henn.)

Neuhaus.

Neuhaus, likewise in Styria, a few miles from Cilli and Tüffer, 1,200 feet above the sea, in a beautiful and pleasing situation, with indifferent baths of 95° Fahr. (35° Cent.), is very similar to Tüffer. There are good whey establishments both here and at Tüffer. (Dr. Schüler.)

Liebenzell.

Liebenzell, in the Würtemberg Black Forest, about five English miles from the Pforzheim station, 1,000 feet above the sea, is situated in a woody valley, with springs which, at a temperature of 72.5° to 82.3° Fahr. (22.5 – 28° Cent.), are warmed for baths, and which contain 5 grains of common salt, with 0.1 grain of carbonate of protoxide of iron, besides a small, but still perceptible, quantity of carbonic acid. For bathing purposes the springs must be regarded as indifferent thermal, since very little is left of the small amount of carbonic acid after the artificial warming of the water; for drinking, however, the amount of salt, of iron, and gas, in it must be taken into consideration, and in this respect the water forms a very weak muriatic chalybeate spring. Liebenzell, therefore, is to be recommended for conditions requiring the soothing effect of thermal treatment, where, at the same time, a perceptible degree of anæmia allows and calls for slight tonic remedies.

Badenweiler, in the Breisgau, for some time a favourite climatic resort for persons suffering from diseases of the chest, possessing a fresh and yet mild climate, and 1,425 feet above the sea, has an indifferent thermal spring of 81.5° Fahr. (27.5° Cent.), which is warmed to a higher temperature when used for baths and swimming baths in large reservoirs. The charming neighbourhood, the beautiful climate, and the rural character of the life and social intercourse, render Badenweiler well suited for those thermal courses of treatment in which the soothing and gently stimulating, rather than the powerfully exciting effect of heat is required. Hitherto Badenweiler has been principally used as a climatic health resort and for its whey-cure; but few places, perhaps, are so well suited as this for thermal treatment. (Drs. Büreke, Siegel, and Wever.)

Badenweiler.

Johannisbad, in the Bohemian Riesengebirge, reached in less than two hours from the railway station in Trautenau, 1,955 feet above the sea, with an indifferent thermal bath of 85.2° Fahr. (29.5° Cent.), is situated in a beautiful and woody valley, possessing an invigorating climate. It is to be recommended for its high situation and simplicity of its life, like the above-mentioned smaller bathing resorts. (Drs. Kopf and Pauer.)

Johannisbad.

In *England* the representative of the hot indifferent thermal springs is *Bath*, which enjoyed a great reputation in former times, but is now rather neglected. It has springs varying from 104° to 120° Fahr., resembling in their constituents the Leuk springs. From its mild and equable climate, and from the frequency of gout in England, Bath is the English Teplitz. [The baths are open during the whole year, but the greater number of visitors go thither between November and April, probably because during the summer and early autumn the climate of Bath is rather relaxing. Considering the great abundance of hot water at Bath, it is rather to be wondered why a military sanatorium for rheumatic and gouty complaints, and the effects of wounds and accidents in soldiers, has not been established there.]

Bath.

[*Acqui*, in Upper Italy, not far from Alessandria, though

Acqui.

it contains a small quantity of sulphuretted hydrogen, scarcely differs in its action from the *hot* indifferent springs. It has springs of different temperature; "*la Bollente*" being 167° Fahr. An addition to the usual thermal method is, at Acqui, the employment of hot mud to the suffering parts, resembling in this respect the moor and mud baths used at different places in Germany. (Dr. Granetti.)]

Lucca.

[Near *Lucca*, in Upper Italy, are the well known *hot earthy* baths at *Ponte Seraglio*, varying from 100° to 129° Fahr. As the solid constituents, amounting to about 2 in 1,000 parts, are of no appreciable influence in the action of these baths, we may mention them among the indifferent thermal springs. The place is principally visited by Italians for chronic rheumatism and cutaneous complaints, but also on account of the cooler climate. The season lasts from spring to autumn, but June, July, and August are the principal months. (Dr. Carina.)]

Luxeuil.

[*Luxeuil*, in the department Haute-Saône in France, at the foot of the Vosges mountains, elevated about 1,300 feet above sea-level, has springs from 65° to 133° Fahr., the mineralisation of which is so feeble as to permit our classing them among the indifferent springs. The climate is agreeable, and the place would be more frequented were it not so near to Plombières. The nearest station is Lure. (Drs. Delacroix, Gauthier, Martin-Lauzer.)]

Néris.

[*Néris*, in the department of Allier, elevated about 800 feet, possesses feebly alkaline hot springs, ranging from 114° to 125° Fahr. The summer is rather hot. Neuralgia, hysterical affections, chronic rheumatism, and uterine diseases are the principal complaints. (Drs. Faure, de Malherbe, and Pirouon.)]

Panticosa.

[*Panticosa*, in the Pyrenees, may be regarded as the most elevated of the indifferent thermal spas, the height being probably about 5,000 feet above sea-level. The springs, situated about two hours from the village, vary from 77° to 92° Fahr. The climate may be called alpine; the accommodation is tolerably good. The principal reputation of the springs is in chronic diseases of the lungs, especially phthisis, and in chronic affections of digestion.

In both the climate is probably the principal agent. (Dr. José Herrera y Ruiz.)]

[Amongst the thermal baths we may direct attention to the *Algerian baths*, which, though at present used principally by natives or French stationed in Algeria, may at a future time become more generally important, owing to peculiar advantages of climate, combined with the thermal heat of the waters. We have been favoured with an account of two of the most famous, *Hammam Meskoutin* (or *Meskhroutin*) and *Biskra*, by Lady Herbert of Lea, who paid them a visit a few years ago. *Hammam Meskoutin* lies in the province of Constantine, about an hour and a half's drive from Guelma. The temperature of the numerous and abundant springs varies from 115° to 203° Fahr., and they are classed by Durand Fardel partly amongst the common salt springs, and partly amongst the ferruginous. The analysis of the latter spring, with a temperature of about 174° Fahr., does not give the exact chemical condition in which it contains the iron, which in all probability plays no part in the *baths*, though it may do so, when internal courses are used; the other springs contain less than $\frac{1}{20}$ per cent. of common salt, and rather more than $\frac{1}{20}$ per cent. of lime, and only 1.5 of solid constituents in 1,000 parts of water; they are, therefore, to all intents and purposes, indifferent thermal springs of a very high temperature, surpassed only by the *geysers* in Iceland. Rheumatic and gouty affections, paralysis, malarious cachexia, old gunshot wounds, and skin-diseases appear to be the principal maladies. There is cheap and tolerable accommodation, and a regular season from the 1st of May to 1st of October, and there is a French military establishment. The baths of Hammam Meskoutin are the *Aquæ Tibilitinæ* of the Romans. The best way to go is, to quote from Lady Herbert's notes, from Marseilles to Bona (two days), thence to Guelma, an easy day's journey, and further by an hour and a half's drive to the baths.

Algerian
baths.

Biskra, in an oasis of palms, with a good little hotel (M. and Mdme. de Midan), is about two days' journey from Constantine by Batna. The climate is hot, suited for

autumn, winter, and spring. The waters are said to be similar to those just described. 'The best place for an invalid would be to go to Biskra for the winter, and then end with Hammam Meskoutin in spring.']

Retrospec-
tive sur-
vey of in-
different
thermal
springs.

From the above enumeration, it is evident that the choice of indifferent thermal springs is no small one, and that wherever a distinct indication in favour of any special thermal method exists, a bathing resort is readily found, which corresponds not only with the indication, but with the circumstances of the invalid. The choice is still further extended if we take into consideration that in many instances the weak thermal *sool-* and *sulphur-baths*, and the weak thermal *alkaline waters*, containing little carbonic acid, may be substituted for the indifferent thermal waters. Such a substitution is occasionally very convenient, and almost necessary if, for instance, a locality is to be found for several members of the same family without separation of the single members. In other cases, the choice must be influenced by psychical considerations; thus it may be necessary to avoid recommending to a hypochondriacal patient a spa where he would meet others similarly affected, for he would probably associate with them, and make his troubles the constant subject of conversation, while his thoughts ought to be directed to other subjects.

E. VAPOUR- AND SAND-BATHS, MONSUMMANO, DOUCHES.

a. *Vapour-Baths.*

Elemen-
tary effect.

The vapour-bath, in its various forms as a simple, Russian, Irish, and sool-vapour-bath, produces in the skin a high degree of hyperæmia and perspiration; it raises the temperature of the blood about 1.8° to 5.4° Fahr. (1° to 3° Cent.), and increases the excretion of the urea, according to Bartels' and Naunyn's experiments. The temperature varies between 122° to 158° Fahr. (50° and 70° Cent.), and therefore very considerably exceeds that of the blood; and thus the heat of the body is increased directly by the hot medium and indirectly by the impeded expenditure of heat, for cooling through the lungs and evaporation through perspiration is prevented in an atmosphere satu-

rated with vapour, except in the Turkish bath, where the medium of dry air promotes evaporation through perspiration. Hence Turkish baths can be borne hotter and longer than real vapour-baths. The following points must also be taken into consideration as regards the elementary effect.—1. It is not merely the atmosphere saturated with vapour which comes into contact with the skin, but also condensed vapour, i.e., fluid water which deposits itself on the cooler skin, and mitigates the heating effect of the vapour. 2. The same process takes place on the respiratory mucous membrane, where water from the warmer air inhaled, also becomes cooler and deposits itself. 3. For these reasons, the vapour-bath can be borne at a far higher temperature than the water-bath, and the Turkish air-bath can be taken much hotter than the vapour-bath. 4. The respirations in the Turkish and vapour-baths become accelerated, and under some circumstances even dangerously so; the pulse is frequent, at first full, but gradually, with a very high temperature or a long duration of the bath without decrease of heat, becoming small and imperceptible. 5. Water is deposited on the respiratory mucous membrane, and acts as a direct and mechanical expectorant. 6. The great heat of the skin is a preparation for the effect of the cold form of bath which almost always follows.

The *therapeutic object* of vapour-baths is either to excite very copious perspiration, and by this means to remove the effects of recent *colds*; or, by the lixivatory effect of violent perspiration and by artificially produced hyperæmia, to stimulate the absorption of long existing rheumatic exudations; or, thirdly, to prepare for the application of *cold forms of baths*, especially of cold sponge-baths, and to render them endurable. In the first case the remedy, briefly and rarely used, responds to the causal indication in treating *recent rheumatism of the joints and muscles*; in the second case its repeated, regular, and methodical use forms a method of treatment of *chronic rheumatism*, the efficacy of which has been tested in cases of rheumatic *neuralgia*, especially in *sciatica*, and it is justly a favourite remedy. On the other

Indica-
tions.

hand, courses of vapour baths, especially Russian baths, which were in frequent use at the time of the Rust school in cases of syphilis, mercurialism, and other states of cachexia, have justly fallen into disuse as equivocal remedies, which, with all their efficacy in counteracting the disease, easily affect the sufferer himself. Lastly, in the third case, the vapour-bath is an element of the *cold water system*; but even in the two first cases, a cold form of bath usually follows the vapour-bath, in order more rapidly to restore the normal natural heat.

Sool-
steam-
baths.

Besides the above-mentioned indications, the moistening of the pituitary membrane stated at point 5, produces a symptomatic indication for chronic and *subacute bronchial catarrh*; this, however, in many cases finds its contra-indication in the heating effect which stimulates and paralyses the respiration and the pulsation. Hence, for this purpose less high temperatures are chosen, such as are usual in the so-called *sool-steam-baths* of Kreuznach, Elmen, Ischl, and others. In these, steam is developed by boiling the sool, partly from the boiling pans of the saltworks, and partly from pans especially designed for the purpose. Residence in this steaming atmosphere is not only recommended in bronchial catarrh but also in phthisis; and the specific effect is ascribed to the component parts of the sool which are thought to become volatile in the vapour, namely, to the chloride of sodium, the chlorine, bromine, and iodine. We find ourselves here brought face to face with one of the numerous and wholly unexplained maxims of balneotherapy: the sool-vapour has been found to contain only a very small amount of the volatile elements, chlorine, muriatic acid, and bitumen; chloride of sodium, iodines and bromine have been sought for in vain by several chemists, and by others have been found in condensed vapour in proportions of 9 to 12 in 10,000 parts of water.

Sool-
spray-
baths.

We must distinguish from the sool-steam-baths just mentioned, the so-called *sool-spray-baths*, such as exist at Kissingen, and in a somewhat high temperature at Rehme. It is not hot steam that is here used, but the patient finds himself in an apartment with a temperature

between 26° and 30° Cent. (78·8° and 86° Fahr.), inhaling an atmosphere which is saturated with vapour, and in which particles of salt are held suspended by means of the mechanical pulverisation of the water.¹

Russian vapour-baths are distinguished by the fact that the vapour is produced by pouring cold water on hot plates, and that the chamber contains different tiers, the heat of which increases with the increasing elevation. Russian
baths.

Turkish baths are not vapour-baths, but hot air-baths; the sick persons are placed in dry hot rooms of different temperature. Subsequent cold treatment is here also employed, as in the Russian and ordinary vapour-baths, by means of cold shower-baths in various forms. The effect on the respiratory mucous membrane here of course does not exist. Turkish
baths.

As a *résumé* of the matter, it appears that the various forms of vapour-baths, in their nature, method, and effect, belong both to the thermal and the cold water systems, and that the indications for their use may be drawn from the maxims laid down with regard to both those systems. If in this sketch, necessarily superficial as it has been for our present purpose, we have limited ourselves to the few above-mentioned indications, we have done so on account of the danger which is combined with the use of a remedy producing such an instantaneous and powerful effect. The study of the cold water and thermal systems, delineated in the course of the first book, will enable the intelligent reader considerably to extend the number of these indications as regards individual cases, and also to perceive that the remedy presupposes in a high degree the precaution of the prescribing physician, and thorough practical experience in the medical conductor of the course of treatment. Résumé.

b. *The Grotto of Monsummano.*

The grotto is situated about a mile from Pistoja, on the southern declivity of the low Tuscan Alban range. It consists of several passages 40 feet wide and of various Monsum-
mano.

¹ See Rehme.

lengths; it is lined with stalactite formations, and contains several pools of water, the largest of which is 20 metres long, 8 metres broad, and 40 metres deep. The water has a temperature of 34 to 35° Cent. (93·2° to 95° Fahr.); it is gaseous, and contains in 16 ounces of water:

Chloride of Sodium	. . . . .	1·8 grains
Carbonate of Lime	. . . . .	4·0 "
Sulphate of Lime	. . . . .	3·7 "
Sulphate of Soda	. . . . .	0·25 "
Sulphate of Magnesia	. . . . .	3·0 "
Carbonic Acid Gas	. . . . .	10 cubic inches

The temperature of the air under the influence of the evaporation of the water, which trickles from the walls, varies between 29° and 35° Cent. (84·2° and 95° Fahr.) in the different parts of the grotto, and it may readily be supposed (though we have no statement of it) that this air is nearly saturated with vapour. We might also suppose (though nothing is known on this point likewise), from the analogy of the vapour-bath at Rehme, that a considerable amount of carbonic acid passes into the air; still, this does not seem to be the case, because all the patients are able to breathe it for a long time without showing symptoms of having inhaled carbonic acid. We may, therefore, regard it as a vapour-bath of from 29° to 35° Cent. (84·2° to 95° Fahr.); and this produces the effect of strong diaphoresis in a temperature in itself endurable, but which, from the saturation of the air with vapour, prevents the evaporation of perspiration, and thus excludes injurious refrigeration. The sick persons sit, attired only in a large shirt and leather slippers, for one or two hours in the grotto, in warmer or less warm places, according to the case, and the perspiration generally is quickly produced.

It is natural that among the usual *indications* diaphoresis should stand foremost, and should be especially emphasised in *rheumatic* cases, as in all forms of the vapour bath; and also that a bath at Monsummano can be borne for a longer time than vapour-baths at a higher temperature, that, therefore, longer and consequently

more effective perspiration is produced. When, however, as is the case in a paper by the bath-physician now lying before us, besides the generally accepted indications of the vapour bath, the remedy is extolled as an infallible panacea against all diseases which are subjected to the cold water or thermal system, and it is asserted that no case has ever remained uncured, we know how to estimate a claim which in Germany is scarcely possible, but may still, perhaps, be admitted in Italy.¹

c. *Sand-Baths.*

Warm sand-baths are an old popular remedy, and have been proved as such in many cases in which the stronger and especially the diaphoretic forms of the thermal system are indicated. They were and still are frequently in use in a natural form by the seaside, in warm countries, and even here and there by the seashore in northern watering places; yet here the treatment requisite for important cases and for rational application cannot be observed. Hence recently, special and, it seems, well-arranged establishments for artificial sand-baths have been set up; for instance, in Dresden (Dr. Flemming), Köstritz (Dr. Sturm), and Berka.

In these establishments, there are sand-baths of from 47° to 50° Cent. (116·6° to 122° Fahr.), lasting from 25 to 45 minutes. The dry sand is warmed on hot iron plates, and by careful mixing is brought to the *uniform* temperature intended, and the extremities and the region of the pelvis are covered with a layer of sand five or six inches deep, and the breast and abdomen with only half an inch. After a few minutes the skin reddens and a violent perspiration breaks out, which is continued during the bath, forming a glutinous crust with the layer of sand with which it comes into contact; this, after the conclusion of the sand-bath, is removed by a warm or lukewarm tub-bath or shower-bath. That in a medium of so high a

¹ Dr. Vioncelli states that a case of inveterate lues was permanently cured by a single bath in Monsummano!

temperature the secretion of perspiration is not sufficient to preserve the normal heat of the body is natural, as the perspiration cannot evaporate; and thus there is an abnormal increase of temperature amounting to 1.5° to 2.25° Cent. (2.7° to 4.05° Fahr.); to our knowledge, however, only in the axillary cavity, but not in the rectum, the heat of which can, in this case, be alone determinative. For the rest, the immediate effect is the same as in very warm water-baths, but somewhat milder. One peculiarity distinguishes the sand-bath, however, from the water-bath; namely, that certain parts of the body can be exposed to a higher continuous heat by heaping up hotter sand.

The *class of cases* which have been tested in the above-named and, it seems, rationally conducted establishments, are the same as we have before designated as suitable for the stronger and especially diaphoretic thermal system; namely, chronic rheumatism, chronic gout, chronic Bright's disease, metallic poisonings, and others. A few particularly striking results merit attention in the same sense as we above observed in speaking of the Monsummano grotto, in so far as they may turn attention to the somewhat neglected diaphoretic mode of treatment.

d. *Douches.*

Douche-baths, and especially the cold, warm, mixed, or Scottish douche, are among the most important local forms of baths, and the latter even is one of the more important general baths. Immoderately extolled at various times and by various authors, they have been somewhat neglected in our sceptical age, and have partly even fallen into disrepute. Few remedies require so urgently the directing hand of the competent physician as do douches, and few are as dangerous in the hand of an enthusiast.

The *mechanical effect* is common to all three kinds, and varies, according to the force used and the volume of the jet of water, from gentle friction to violent pressure; in fact, to violent contusion of the skin and cellular tissue, and in its strongest forms to rupture of the capillaries of even medium size, and even to the bursting of the

covering of pathological swellings; it has even been recently ascertained that a fine jet of water pierces the skin like a needle.

In the *cold douche* the *influence of the cold water* is added as an essential agent, and this in its *stimulating effect*, whilst its depressing effect is scarcely to be measured, because with the motion of the water the refrigerating effect, though increased, becomes at the same time unequal and variable. It is true, frequently, in accurately regulated experiments, the pulse has been found, not only very weak, but even imperceptible, and even rigor has been observed; these symptoms, however, do not belong to the category of soothing effects, but of violent depressing ones, and they are to be avoided in acute as well as in chronic cases, and especially in psychoses. There are better forms for the soothing and cooling effect of cold water; and even in producing a generally stimulating effect we have almost abandoned the douche, and prefer other forms.

The *local effect* produced is the main object of the cold douche. It is effected partly by a mechanical action like to kneading, and partly by the stimulant of cold and its reaction; it produces, after the cessation of the immediate effect, a hyperæmia of the capillaries, which may amount to inflammation, and subsequently a more lively circulation, retrogressive tissue-change, absorption, and formation of new matter. Varices, telangiectases, transudations in the subcutaneous cellular tissue, cold abscesses, atonic ulcers of the foot and leg, white swelling and similar torpid exudations and growths in and about the joints,—these are the most important indications for the use of the local cold douche. More indirect, although likewise local, is its effect when applied to the head, the vertebral column, and the trunk. Yet in these cases the indications afforded are not so free from doubt and risk. Rarely has a physician the courage to apply cold water as a douche in diseases of the brain and spinal marrow.

The *warm douche* is a milder form; the mechanical effect is about the same, but its result is greater, because the superficial parts of the body offer less resistance in the

Cold
douche.Warm
douche.

heat to the process of shampooing; the withdrawal of heat is wanting, and consequently all reaction, and the whole process has predominantly the character of kneading. The final effect consists in a more passive stasis, when the water applied is above the temperature of the blood, and in a greater action of the parts influenced by the douche when the heat was more moderate. The remedy is adapted to the same class of cases as the cold douche, and should be used in those cases where there is reason for sparing the sick person the work of the reaction.

Scottish
douche.

The *mixed or Scottish douche* consists in the frequently repeated alternation of cold and warm jets, and this form deserves the preference in a great number of cases. It is the safest form, because it effects in a physical manner the reaction which, under any circumstances, is required from the organism in the cold douche; and it altogether closely adheres to the principle of organic life which consists in the alternation of the phases of stimulation and contra-stimulation, of excitement and repose, and of cold and heat. The remedy is much neglected, and is quite unknown to many, although its reasonableness is supported by the successful experiments of Lebert, who found it extremely efficacious in spinal paralysis.

BOOK II.

MINERAL BATHS.

The special chemical qualities of mineral baths, and the pharmacodynamic character of the characteristic groups.—Sool-baths, gaseous thermal sool-baths, sulphur-baths, moor-baths, alkaline baths and supposed chalybeate baths.—Pinewood-baths.

MUCH as it may be advisable for other reasons to exhibit the pharmacodynamic character of the different mineral springs with regard, at the same time, to their external and internal use, still we prefer a separate treatment of the subject, in order to keep the two essentially different forms of application distinctly apart; and, after having examined the general modes of treatment with cold and warm baths, as they are given in the First Book, to proceed to bath treatment with chemically different waters, and thus to circumscribe the range of true bath treatment. From our remarks upon the subject in the former book (p. 77 *et seq.*) we have to put out of account, in the effect of baths, the absorption of saline elements, and we have only to take into consideration the absorption of gases, such as sulphuretted hydrogen and carbonic acid. In the estimate of *baths*, therefore, we may set aside the amount they contain of iron, lime, the sulphates of soda and of magnesia, soda, iodine, bromine, and arsenic; and as special baths we have only to consider those containing carbonic acid, the sulphur-baths, and besides these, the sool-baths, the clinical effect of which is established, and to be explained in a mechanically chemical manner; the moor-baths, in which special chemical agents are added to the general thermal effect, and sea-baths. The amount contained of other salts is only of importance in courses of drinking; and even the gases, sulphuretted hydrogen and carbonic acid, taken internally, produce a thoroughly different effect from that caused by their outward application to the skin.

CHAPTER I.

BATHS CONTAINING COMMON SALT—SOOL-BATHS.

Sool-
baths.
General
character.

SOOL-BATHS have ever been the most usual baths, preponderating in number above all others. The class of diseases for which they are used formerly extended over the whole range of balneotherapy, and this all the more, as a great part of the effect was ascribed to the absorption of salts. With the introduction, however, of the cold water system, with the increasing use of indifferent thermal springs, with the elementary study of the effect of water, with the enlarged appreciation of sea-baths—in short, with the growing knowledge which for some years has begun to cast a light upon the obscurity of balneotherapy—the use and the indications for the use of sool-baths have become limited and definite. A great part of the indications formerly and still in use, and the results experienced, depend on the effect of the warm water which belongs to sool-baths, in common with *indifferent* thermal baths; and the advantage of sool-baths rests, according to clinical experience, in their powerful influence upon the better nutrition of scrofulous patients, upon the absorption of scrofulous swellings, and upon the strong stimulation of the skin in rheumatic cases. It has, moreover, been a fact generally established, that the required stimulation of the skin is produced in a strong sool-bath at a *lower temperature* than in an indifferent bath. Whether, as still remains to be proved, a slight absorption of common salt, which forms an important and constant component part of the blood, may be taken into account in this effect, is very questionable; and the only explanation of the matter at present possible is satisfied with the assumption of a stronger stimulus exercised upon the

skin, vessels, and nerves by the common salt, an explanation which finds some support in the well-known corrosive effect of concentrated solutions of this substance.

In connection with this explanation, there stands the fact that sool-baths are more powerful than simple water or alkaline baths in promoting the nutrition of scrofulous children, and in inducing a better circulation and a more healthy condition of the skin. It is supported, moreover, by the observation of the course of the treatment, during and after which, as the symptoms of the disease vanish, the appetite and the power of assimilation increase and the weight of the body becomes greater. Lastly, it is upheld by the investigations of Beneke, L. Lehmann, and others, who have demonstrated in the urine increase of tissue-change. All this shows that the sool-baths resemble sea-baths in their mode of action, but that they act more gently. *Powerful stimulation and nutrition of the skin and increase of tissue-change* form the dynamic character of sool-baths. From concurring experiments, the effect of *sool-baths*, like that of all baths, predominantly relates to the increased change of non-azotised substances, while, on the contrary, the *drinking* of *sool-waters* effects rather the change of the azotised; what quantitative amount of salt is required for this effect it is difficult to ascertain, as the skin of different individuals possesses a very different degree of irritability. Generally speaking, an amount of 2 or 3 per cent. may be designated as a medium quantity capable of an effect in most cases. A solution of 10 per cent. often acts as an irritant, but in many susceptible individuals a slight concentration of $\frac{1}{2}$ to 1 per cent. produces the exciting effect; in this case, the other combinations of chlorine with magnesium and calcium are added to the chloride of sodium, and must be taken into account. As, however, most sool-springs possess a greater amount of chlorine salts, either by nature or by graduation, and the baths, by means of dilution, are given at the strength required, the choice of the bathing resort is regulated far less by the analysis of the waters than by accompanying circumstances and local relations.

Whatever amount, however, of other salts, such as iodine and bromine, is contained in them, need not be taken into consideration in their use as *baths*, so long as no considerable absorption of these salts is proved or rendered probable. The case is different with the carbonic acid, which adds an important element to the effect of sool-baths, and also with sea-baths, which, from their short duration, depend less for their effect on the amount of salt they contain, than on the mechanical influence of the undulation of the waves, the coldness of the water, and especially the influence of the sea-air. In estimating the effect of sool-baths, special attention must be paid to their use in scrofulous cases, as to whether a course of waters is to be combined with the course of baths, and what share in the general effect produced may be ascribed to the sool-baths and what to the drinking of sool-waters. From individual experience, as well as from balneological literature, it appears that the mixing of the two modes of treatment produces a confusion which renders all distinct differential indications very difficult; a success or a failure, or any therapeutic experience at all, in Kreuznach, for instance, possesses no general value, if it do not tend to explain the distinction between the two courses of baths and drinking; and we shall see, when we come to the important alternative between Kreuznach and Rehme, how much depends on the critical separation of these two remedies if we would lay down various and individual indications for different cases of scrofula.

EXAMINATION OF INDICATIONS.

*Common for
sool-baths.*

There are three things which characterise the effect of sool-baths. In the first place, in common with indifferent thermal baths and all other baths, they have the effect of the *warm* water; in the second place, in addition to this effect, they produce greater *stimulation of the skin* and *stronger influence on the changes of substance*; and in the third place, they exhibit their effect by means of this greater stimulation, generally speaking, at a *lower temperature* than is the case with simple waters, so that

a strong sool bath of 35° Cent. (95° Fahr.) is equal, as regards the feeling of the sick person and the effect of the bath, to an indifferent bath of 38° Cent. (100·8° Fahr.). Upon these three points of consideration is based the examination of the current indications (i.e., their applicability in different morbid conditions).

1. *Weakness of Skin* (see pp. 110 and 139).—Warm and relaxing baths are in this case prohibited, and the cooler mode of treatment is indicated. At the places referred to, the *cold water system* and *sea-bathing* were designated as the strongest remedies, and *gaseous thermal sool-baths* as a medium form of bath; and in urgent cases, and where weakness of skin is the preponderating object of the treatment, the choice lies between these remedies. The cold water treatment was considered suitable for more isolated weakness of skin, and sea-bathing was recommended* in cases when the latter was only the symptom of a generally depressed nutrition; and the thermal sool-baths were recommended where the weakness of the skin was in itself so great that every application of cold or cool water would necessitate fresh cold. Similar importance, as a medium form of treatment, belongs to the *sool-baths*, the stimulating effect of which upon the skin with a temperature of 1 to 4° Cent. (1·8° to 7·2° Fahr.) below blood-heat, and the general effect of which on change of substance and nutrition of the body, but especially of the skin, impart to them the character of a milder form of sea-bathing. Hence they are frequently employed, and experience has sufficiently confirmed their effect—1. When a moderate degree of weakness of skin either leaves the choice free between the remedies mentioned, or the cold water system and sea-bathing are found too cool, while the stimulus of carbonic acid is to be avoided; 2. When the weakness of skin is the accompanying symptom of another condition, for which, from other reasons, preference is given to the sool-baths. The degree of concentration in the sool-bath is to be regulated according to the individual sensibility of the skin; but, in general, stronger degrees are to be preferred, and this all the more as they allow a cooler temperature of bath.

Weakness
of skin.

Exanthemata.

2. *Chronic Exanthemata* (see pp. 111 and 146).—In former years saline baths had a great name in this class of cases, but experience is against it. The author has been for eighteen years physician of a much frequented bathing resort, which affords, besides thermal sool-baths, simple gasless sool-baths; and he has had constant opportunity of seeing the inefficiency, and even the perniciousness of sool-bath treatment in cases of chronic exanthemata. In *eczema* he has never seen any good, but only harm. *Acne* and *syccosis* remain unaffected; occasionally a slight case of *psoriasis* is cured, but not without a return occurring after two years. Nothing but slight degrees of pustulous forms, which accompany scrofulous conditions, can be remedied or removed, such as *impetigo*, *crusta lactea*; *pityriasis versicolor* is likewise temporarily removed, but it reappears, unless such strong and hazardous remedies as sublimate lotions be used. This experience has been confirmed on many sides; and by Hebra, to whom, as a genuine empiric, every remedy is welcome, so long as it is supported by any theoretic idea, or by any authenticated success, we find the sool-baths, the great panacea of the schools, as little mentioned as if they did not exist at all.

Pernicious effects of salt water.

The saline ingredients in most cases exercise an injurious effect by local irritation. The reason lies in the nature of exanthemata; the healthy epidermis, impermeable to all external fluids, is wanting, and the thick deposits, crusts, scurf, and scabs allow all fluid matter to penetrate to the bare and sensitive layer of skin lying immediately below them.

That here and there a case of *psoriasis* is cured by means of sool-baths, can establish nothing; it only confirms the old experience that the organism can endure exceptionally what, as a rule, is pernicious to it. Very rare, however, are the cases in which *eczema* is not aggravated by salt baths.

Ulcers of the feet and legs.

Of all the cases belonging to diseases of the skin, there only remain those of *atonic ulcers* of the feet and legs, which, indeed, not only bear such a violently irritating remedy as salt water, but are cured and improved in consequence of its

effect. Nevertheless, these are scarcely to be regarded as skin-diseases, as in this case the skin for the most part only suffers secondarily, while the real malady has its seat in the subcutaneous tissues and veins. And even here it must be remarked that bath treatment is but rarely sufficient to affect any radical and lasting results, unless other stimulating remedies, and especially bandages, be used as accessories.

3. *Rheumatic Conditions.*—In the treatment of rheumatic maladies, the causal indication very frequently demands the removal of the accompanying and causative *weakness of skin*. The importance of sool-baths in counteracting this symptom has been mentioned above (see page 195). Rheumatism.

In *muscular rheumatism* the points mentioned in discussing thermal treatment (page 137) must be taken into consideration; and in the treatment by sool-baths the effect of the moist heat is combined with a stronger stimulation of the skin, and through this a greater influence upon the circulation and absorption in the muscles affected. This explains the stronger and quicker effect of sool-baths in cases of muscular rheumatism, and the preference which belongs to them generally above indifferent and alkaline thermal baths. As warm baths, in a great number of cases the choice may be unimportant between them and not very warm thermal baths, only that a quicker result is, generally speaking, to be expected from them; in other cases this choice must be regulated by plainly indicated individual conditions. For individuals requiring delicate management, *highly situated indifferent baths*, and a few *sool-baths* in subalpine positions may be selected; for cases with much impaired nutrition and slight rheumatism, *sea-bathing* may be recommended; for severe cases, but when the violent effect of greater heat is prohibited, *gaseous thermal sool-baths* may be taken, or warm salt baths by the sea-shore; and for corpulent and indolent natures, the *cold water system* may be used. Muscular rheumatism.

Chronic joint rheumatism, especially considerable joint exudations, require (see page 141) for the most part very powerful remedies to promote absorption, such as the *cold* Articular rheumatism.

water system and hot thermal baths. Among the remedies recommended for this malady, which is difficult to cure, sool-baths take a prominent place, though with some limitation; not every sool-bath, and not every mode of sool-bath treatment is adapted for joint-exudations of any extent or length of standing, but only those which approach the stronger thermal method. The reputation which *Wiesbaden* enjoys for these diseases arises far less from the slight amount of salt contained in its thermal springs, than from the high temperature of its baths; experience therefore attributes to *Wiesbaden* in this respect no other power than to *Teplitz* with its indifferent baths. All that *Wiesbaden* and *Teplitz* offer, is furnished by every sool-bath of the same high temperature; in fact, a greater amount of salt renders the same powerful effect possible with a lower degree of heat, and the great influence produced upon the change of substance tends also to promote the absorption of exudations.

Mild thermal courses, however, or, according to circumstances, the use of sool-baths of moderate temperature, are to be recommended in those cases in which judicious treatment relinquishes the idea of absorbing the exudations, and restricts itself to checking the progress of the disease and increasing the strength, and avoiding violent courses of treatment which only promise a most uncertain result. In these cases a moderate course of sool-baths of 32–37° Cent. (89·6° to 98·6° Fahr.) generally possesses the great advantage that a course of waters—for example, *Carlsbad* waters—can be combined with it without making too great demands on the resisting power of the organism, while very warm bath treatment for the most part prohibits a searching course of waters.

Gout.

4. *Gout.*—The case is perfectly similar in the treatment of gouty exudations, for which, both in theory and from experience, the preference among balneotherapeutic means belongs to the strong lixiviative forms of the cold water and thermal systems, besides courses of *Carlsbad* waters or the like (see pages 115 and 134). The prognosis is here still more unfavourable than in rheumatic exudations, and hence a wise limitation to that which is possibly attain-

able is still more urgently and frequently called for. In this case also, the great reputation which *Wiesbaden* shares with *Teplitz* has its ground in the high temperature of the baths, and in addition to this, in the usual *course of drinking* its warm salt water, which, being only slightly saline, is borne by many sick persons, and which powerfully assists the effects of the baths on the absorption. Assuredly all sool-baths, if they be only given very warm, deserve the same recommendation as in rheumatic exudations; and here also they may be urgently recommended at less high temperature in those cases, which are still more frequent in this disease, where the absorption of exudations is put out of the question, and the improvement of the general health is all that is aimed at.

5. *Neuroses*.—In neuroses, sool-baths offer only the advantages of warm water baths, excepting that, owing to the salt, they can be administered at somewhat lower temperatures. The preference of sool-baths, as such, only refers to those cases in which a more powerful stimulation of the tissue-change is permitted and required, and also when the rheumatic character of the malady, or a certain amount of weakness of skin, indicates the stronger stimulus of salt water. Neuroses.

6. *Scrofula*.—Scrofula is the most frequent subject of balneotherapeutic treatment; and altogether, as one of the most widespread diseases, it is provided with an almost countless number of puffed and customary remedies. Scrofula.

Of all the specific remedies formerly used, only a few are still in vogue, namely, iodine and iodide of iron, cod-liver oil, courses of salt waters, sool-baths, gaseous thermal sool-baths, and sea-baths; and the effect of these few remedies is necessarily aided by more general measures, such as the mode of bringing up, gymnastics, diet, and climatic choice of residence.

In the choice between sool-baths, courses of iodine, courses of waters, thermal sool-baths, and sea-bathing, lies the rational treatment of scrofula; and this choice is based in general upon two different requirements, and in each individual case one of the two may predominate over the other, or both may have equal importance. Either Therapeutic alternative in scrofula.

General.
restora-
tion of the
nutrition.

the general improvement of the nutrition, or the rapid absorption of exudations, is predominantly required. In the first case, the local affections, whether as regards their extent or their seat, are so unimportant that, in themselves, they do not essentially disturb the functions and the nutrition of the tissues, nor greatly interfere with the result of a general course of treatment for the improvement of substance, a result which depends on a certain soundness of the functions; in the other case, on the contrary, the local affections are so disturbing and threatening, that they not only impede nutrition and the formation of blood, but they even paralyse the effect of a course of treatment designed to influence the change of substance. In the first case, methods producing a general effect, and these *only*, are indicated, such as country life, well-regulated diet, stimulation of the stomach by tonic remedies, sool-baths, sea-baths, and gaseous sool-baths, according to the greater or lesser impairment of the powers of nutrition. These remedies promote the change of substance, and with it the absorption of the slight exudations, which even in themselves, but little, or not at all, disturb the nutrition. Foremost of all stands *sea-bathing*, the ideal of all modes of treatment for promoting change of substance and nutrition; yet this requires good functions of assimilation, and a constitution which can bear the shock of cool and greatly agitated baths. A milder effect is produced by *sool-baths*, which promote the change of substance without making these greater demands on the organism; and between the two remedies stand the *gaseous thermal sool-baths of Rehme and Nauheim*, the strongly stimulating effect of which produces a result similar to that of sea-bathing. In the second case, where the *rapid absorption of exudations* is required, especially in a great number of lymphatic glands, when by impeded lymphatic circulation the excretion of used-up tissues and the supply of digested nourishment is so considerably hindered that from this local cause nutrition is much lowered, the above-mentioned remedies are of no avail, because their general effect is prevented by the local affections. To treat these cases with an ordinary course of sool-baths,

Absorp-
tion of
serofulous
exuda-
tions.

sea-baths, or thermal baths at Rehme, is quite useless, until the glandular exudations are diminished by an absorbent treatment to such a degree as to permit a better circulation of lymph.

As a means for producing so strong an absorption, the following have been found efficacious: 1, the internal use of moderately aperient *common salt waters*; 2, mild but continued courses of *Carlsbad* water, which deserves more frequent use in scrofulous exudations than it habitually enjoys; 3, strong lixiviating *cold water* and *thermal* treatment; 4, the internal use of *iodine*, especially in combination with *sool*-baths, or other baths of some duration.

Only a few cases of this class of scrofulous diseases are suited for the *strong thermal* treatment of very warm and prolonged baths, although these cases belong to the so-called *torpid* form; the strong stimulant of heat generally produces such violent irritation as is rarely borne in the low state of nutrition, and the torpid form of disease is changed into the erethic. On the other hand, the thermal mode of treatment is frequently and with tolerable success used for adults with whom a great part of the cervical glands is enlarged, although even then, in severe cases, a cure is alone to be expected from the knife.

Thermal
system.

The *cold water system*, used in as vigorous a manner as the promotion of considerable absorption requires, likewise lies in most cases beyond the capability of the organism, and from its use, as with that of the severe thermal system, the congestion of the internal organs is always to be feared.

Cold water
system.

Courses of common salt waters and Carlsbad water, if taken with regard to individual circumstances, are almost always bearable, and very often, combined with *sool*-baths, fulfil the object of stimulating the absorption and the lixiviating change of substance. Leaving further details to the third book, we will only here observe that the effect of both kinds of waters is about the same, namely, stimulation of the peristaltic motion and the intestinal secretions, increase of the secretion of bile, supply of soda to the blood for the maintenance of its

Courses of
waters.

Common
salt water
and
Carlsbad.

alkalescence, the direct increase of the retrogressive change of substance, and in consequence the indirect promotion of the productive change of substance. The difference between the two kinds of waters lies in the different degree of the effect produced; Carlsbad is milder than most common salt waters, the secretions are less, the local effect on the intestinal membrane is more moderate, and whilst in the use of common salt waters the laxative effect, whether copious or not, proceeds for the most part from a *catarrhal irritation*, in a milder course of Carlsbad waters there is generally a simple serous *secretion*, and while in the one case the salts introduced are frequently removed with the excrements by the catarrhal diarrhoea, in the Carlsbad water the absorption of the salt takes place more easily and fully. There are, it is true, very weak common salt waters, such as *Kissingen*, which contains 44 grains of chloride of sodium in 16 ounces, *Mergentheim*, which contains 31, *Wiesbaden*, 52, some springs in *Soden*, between 17 and 26, *Schmalkalden*, 71, *Cannstadt*, 16 to 19, *Baden Baden*, 16, *Bourbonne-les-Bains*, 46, the bog-springs in *Arnsdorf*, 26, the *Elisenquelle* in *Kreuznach*, 29, *Bad Eichen*, 49 and 71, *Adelheidsquelle*, 38, and even *Hall*, 112; but it is also necessary to be satisfied with these weaker waters and not, at any rate without dilution, to give to the anæmic organism and the weakened intestinal membrane of a scrofulous child waters containing 200 to 1,000 grains of salt, just because they happen to rise at the respective bathing resorts. In the same manner it is often advisable to choose salt water containing carbonic acid, such as *Kissingen*, *Cannstadt*, and *Soden*, in preference to those devoid of gas, because the carbonic acid promotes the digestibility of the water and its absorption; and hence, as regards its general effect upon the blood, a smaller quantity of gas containing salt water is usually sufficient than of that devoid of gas. The transmission of natural and artificial mineral waters renders a choice of them possible at every bathing resort, and it is frequently unadvisable to use the water of the place which is suitable for a course of baths, for a course also of drinking.

Iodine treatment is most safely carried out by means of accurately weighed doses of pharmaceutical preparations of iodine, increased and diminished according to the individual requirements. The usual doses of ordinary preparations of iodine, such as iodide of potassium and iodide of iron, are two, four, six, or eight grains, up to half a drachm in the day; in many cases still larger doses have been given without injury, and for children, the daily dose, if it be intended to produce rapid absorption, is, at the least, six or eight grains, according to the age.

Iodine
treatment.

If we compare with this pharmaceutic treatment the ordinary use of mineral waters containing iodine, we meet with a remarkable contradiction. In *Kreuznach*, scrofulous children are given the Elise spring up to 20 or 30 ounces a day, and with this quantity ($0\cdot035$ to 16 ounces) $\frac{4}{1000}$ to $\frac{7}{1000}$ of a grain of iodide of magnesium; in *Krankenheil*, $\frac{1}{1000}$ of a grain of iodide of sodium; in the *Dürkheim* spring an equal quantity; in the *Hall* iodine waters $\frac{7}{1000}$ to $\frac{1}{100}$ of a grain; in the *Adelheid* spring $\frac{3}{100}$ to $\frac{4}{100}$ of a grain. Supposing that the bromide of sodium and bromide of magnesium, in spite of the fact that the effect of bromine has not yet been accurately defined, are regarded as similar in effect to the iodine combinations, and as such added to them, the following estimates would result: at *Kreuznach* $\frac{7}{100}$ to 1 grain of iodine and bromine combinations; at *Dürkheim* $\frac{1}{100}$ to $\frac{3}{100}$; at *Hall* $\frac{6}{100}$ to 1 grain; for the *Adelheid* spring $\frac{6}{100}$ to 1 grain; whilst the *Krankenheil* water contains no bromine. As the medicinal dose of bromide of sodium is the same as that of iodide of sodium, and even if we may venture to regard the bromine as similar in effect with the iodine, and may therefore add the quantity of the former to that of the latter, there is in all these waters not more than one grain of iodine salt daily introduced into the body, i.e., no more than the sixth or eighth part of the dose which in moderate cases has been proved efficacious, and only the thirtieth part of that required in severe cases.

Iodine
waters.

In the feeling of this contradiction, the advocates of the usual iodine waters have laid down the assertion that the peculiar combination with other salts promotes the

absorption of the iodine. We possess, however, no proof for the correctness of this view. The result of our detailed statement is evident: so long as no new and unknown elements are discovered in ordinary iodine waters, and so long as there is no proof that an iodine salt is ten and twenty-fold stronger in its effect in a solution of common salt than in a simple solution of water, so long we are not justified in regarding these mineral waters, with respect to their effect, as strong iodine remedies and in prescribing them as such. Kreuznach contains almost 100 grains of chlorides in 16 ounces; Dürkheim 87; Hall 118; Adelheid 38; and these are, therefore, to be considered as common salt waters in their effect upon absorption. Krankenheil, however, has only altogether 6 grains of solid parts, among which there is somewhat more than 2 grains of common salt and about as much carbonate of soda; it is therefore nothing more than a spring with $\frac{1}{100}$ of a grain of iodide of sodium to 16 ounces. From all this, the advocates of the medicinal springs and of the error which has found its way both into literature and into practical treatment, must allow the sober practitioner to refer the internal effect of these mineral waters to the amount of common salt they contain, and when a course of iodine is indicated, to give the larger and accurate medicinal doses which have been tested by clinical experience.

Anæmia.

7. *Anæmic conditions.*—The milder courses of sool-baths of moderate temperature and short duration, which effect invigoration of the skin and moderate increase of tissue-change, are not only useful in the general weakness of the nutrition belonging to scrofulous constitutions, but also in other anæmic conditions, and compete with courses of iron, as will be pointed out when we come to the discussion of this mode of treatment. (See Book III.)

Various exudations.

8. *Non-scrofulous exudations*, like scrofulous ones, are among the cases requiring strong sool-bath treatment, with warm and somewhat prolonged baths, and with the internal use of mineral waters containing common salt, and others. To these diseases especially belong the various forms of *joint-inflammation*, *periostitis*, *caries* and *necrosis* of the bones, and *tumours in the pelvic organs*,

in which latter cases, however, sool-baths, like all other remedies, do not promise very important results; also enlargements of the *testicles* and *mammæ*; in short, all organic disturbances of the nutritive organs, in which a general increase of the change of substance is to be aimed at as a means of cure for the local affection. The competition of sool-baths in individual cases with all forms of cold water and thermal treatment, is to be estimated from the individual conditions of the case, and from the fundamental character of the various methods which we have already delineated.

CHOICE OF SOOL-BATHS.

The difference between the numerous baths consists only in climate, and scarcely in the varying strength of water, as in most places there are baths of different degrees; it is scarcely comprehensible how, even at the present day, special classes of cases are brought forward as specially adapted for Ischl, Baden, and many other sool-baths. A sool-bath is a sool-bath, i.e., a solution of chloride of sodium, with slight quantities of chloride of calcium, chloride of magnesium, and other salts; and only through this amount of chlorides it produces a strong effect upon the skin, and through this upon the central functions. When the natural or artificially prepared sool is too weak, it is strengthened with concentrated sool, with bath-salt produced by evaporation, or with mother-lye (Bittern), i.e., the much concentrated solution of chloride of calcium, chloride of magnesium, chloride of potassium, with chloride of sodium, and other salts, left behind after the separation of the greater part of common salt; when it is in itself already very strong, as, for example, at Ischl, Kösen, and other places, it is diluted. The amount of concentration at which a sool-bath is endurable, and at which it exercises the effect peculiar to it, and which is caused by dilution or addition, amounts on an average to 2 to 4 per cent. of chlorides; but on very excitable persons, weaker solutions, and with a very torpid skin even stronger solutions,

Slight
practical
difference
between
the various
sool-baths.

Mother-
lye.

produce a beneficial and stimulating effect. In many bathing resorts, especially those which are combined with salt-works, the concentration is effected with graduated sool, in others with bath-salt or with mother-lye; and on the nature of these it depends, whether chloride of sodium preponderates in the water of the bath, or whether chloride of calcium and chloride of magnesium prevail. As, however, all these different chlorine salts produce the same stimulating effect upon the skin as common salt does, an effect which proceeds only from the chlorine and not from the base, and which, so far as we know, is not even modified by the latter, the choice between the various mother-lyes and bath-salts is a matter of indifference, and it is sufficient to know their quantitative amount of chlorine combinations, in order to decide accordingly the addition necessary for the intended strengthening of the bath. The proportions of bromides and iodides are too small to be of practical importance for our purpose.

Graduation of
baths.

A sool-bath of medium strength is one the water of which contains 2 to 4 per cent. of chlorine combinations, thus about 150 to 300 grains in 16 ounces. If this amount, or, according to circumstances, a greater or lesser amount, is to be produced, the quantity of saline matter to be added is to be calculated from the percentage of chlorides in the natural bath-water, from the percentage of chlorides in refined sool-bath-salt or mother-lye, which is to be used for strengthening, and from the quantity of bath-water, which in ordinary tubs amounts to 500 or 700 pounds. For this purpose, in the following table we give a comparison of several additions most frequently used:—

The concentrated sool of *Ischl*: 1,900 grains of chlorine combinations to 1 pound, or 25 per cent.

The concentrated sool of *Hall*: the same.

The concentrated sool of *Münster am Stein* (*Kreuznach*): 1,100 to 1,500 grains, or 14 to 18 per cent.

The concentrated sool of *Rehme*: 600 to 1,100 grains, or 8 to 14 per cent.

The concentrated sool of *Dürkheim*: 2 to 13 per cent

The mother-lye (Bittern) of *Kreuznach*: 2,400 grains, or 34 per cent.

The mother-lye of *Elmen* : 1,200 grains, or 16 per cent.

The mother-lye of *Salzungen* : 2,270 grains, or 34 per cent.

The mother-lye of *Reichenhall* : 2,560 grains, or 33½ per cent.

The mother-lye of *Arnstadt* : 2,690 grains, or 35 per cent.

The mother-lye of *Dürkheim* : 3,000 grains, or nearly 40 per cent.

The mother-lye of *Pyrmont* : 1,880 grains, or 24 per cent.

The bath-salt of *Wittekind* : 4,840 grains, or 64 per cent.

The bath-salt of *Arnstadt* : 2,690 grains, or 32 per cent.

There are, however, several sool-springs which in their amount of chlorine approach the mother lyes, and therefore, in proportion to their strength, must be diluted with simple water. The following are among the most known :

Salzungen, with 1,997 grains of chlorine combinations, or 26 per cent.

Reichenhall, with 1,736 grains, or 24 per cent.

Jaxtfeld, with 1,970 grains, or 25 per cent.

Arnstadt, with 1,811 grains, or 23 per cent.

These springs may be regarded as mother lyes, and may be treated as such, i.e., diluted.

There are other salt-springs which possess such a slight amount of chlorine combinations that they can only be regarded as sool-baths after receiving the concentrated addition necessary ; for example, *Baden-Baden*, with 18 grains of chlorine combinations to 16 ounces, or 0·24 per cent. Weak sool-springs.

Cunnsstadt, with 15, 16, and 20 grains, or 0·24 per cent. on an average.

Kronthal, with 23 and 28 grains, or 0·3 and 0·36 per cent.

Adelheid, with 38 grains, or 0·5 per cent.

Soden, near Aschaffenberg, with 40 and 111 grains, or 0·51 and 1·6 per cent.

Wiesbaden, with 45 and 58 grains, or 0·6 and 0·8 per cent.

Mergentheim, Bourbonne, with 52 grains, or 0·7 per cent.

Kissingen, with 45·50 and 137 grains, or 0·6, 0·65, 1·7 per cent.

Iwonicz, with 47 and 60 grains, or 0·6 and 0·8 per cent.

Dürkheim, with 46, 70, 88, and 96 grains, or 0·6, 0·85, 1·2, 1·28 per cent.

Wildeg, Schmalkalden, Salzhausen, with 80 grains, 1 per cent.

Homburg and Mondorf, with 95 grains, or 1·24 per cent.

Hall (Austria), with 100 grains, or 1·3 per cent.

Kreuznach, with 77, 91, 122 grains, or 1, 1·2, 1·6 per cent.

Soden (on the Taunus), the strongest spring, with 116 grains, or 1·7 per cent.

It may be remarked for the further illustration of this arrangement, that in *Kreuznach* (with 1, 1·2 and 1·6 per cent. of salt), only very rarely the natural sool alone is used for baths, but in most cases it is combined with mother-lye salt; and thus the above-named and partly much weaker baths must submit to be reckoned among sool-baths only on condition that arrangements for strengthening the bath water are connected with the spring. Where these are wanting, as, for instance, at *Baden-Baden* with 18 grains, and at *Cannstadt* with 15 or 20 grains to 16 ounces, the baths only possess the importance of artificial or natural indifferent thermal baths; in a few other weaker sool-springs the slight but perceptible amount of carbonic acid has to be taken into consideration as an accessory remedy.

Addition
of mother-
lye.

If a bath, therefore, at *Baden* or *Cannstadt* is to be strengthened by the addition of a foreign mother-lye to an actual sool-bath—for instance, 3 per cent.—there are, reckoning the bath at 500 pounds of water, 12,000 grains of chlorine combinations existing in the bath water itself; 137,000 grains, however, are equal to 3 per cent., and accordingly 125,000 grains must be added, an amount corresponding with a quantity of 52 pounds of *Kreuznach* mother-lye. By this means each single bath is raised 3

or 4 thalers above the ordinary price, and this enhancement of price, even in the stronger of the above-mentioned weak sool-springs, always amounts to 1 or 2 thalers. In order to obviate this financial difficulty, the patient contents himself, both at home and at many bathing resorts, with a slight addition of $\frac{1}{2}$ to 2 quarts, which of course fails to produce the desired effect, and is only of nominal importance; the expense even is grudged of 12 or 15 pounds of common salt, which would meet the necessity. As, however, such a misuse of the name of a remedy and ignorance of the necessary dose sensibly affects the real value of sool-baths, and the price of several thalers for a single bath is not indifferent to most invalids, we consider this point sufficiently practical in its character to rest upon it the classification of the various sool-bath establishments.

*Weak Sool-Baths without the means of concentrating
the Bath Water.*

Baden-Baden, terminal station of a branch line on Baden, the Baden railway, situated 616 feet above the level of the sea in a splendid valley, is, from its extremely mild climate, which permits baths to be taken until late in the autumn, from its comfortable hotels, villas, and private houses, and further from the great influx of strangers of all nations, and especially of the higher and highest classes, one of the most magnificent bathing resorts in Germany, and perhaps in the whole world.

The extremely abundant springs, from 46 to 68° Cent. (114.8° to 154.4° Fahr.), contain only 22 grains of fixed component parts in 16 ounces. Among these there are $16\frac{1}{2}$ grains of chloride of sodium, and such slight traces of free carbonic acid that they cannot for external use be regarded as sool-springs, but only as indifferent thermal waters. The ordinary symptoms of gout, slight forms of scrofula and rheumatism, are therefore partly subjected to a *course of water-drinking*, for which the weak salt water is excellently adapted, and partly to the effect of the *indifferent baths*. The remarks on thermal treatment in the last

General.
restoration of the
nutrition.

the general improvement of the nutrition, or the rapid absorption of exudations, is predominantly required. In the first case, the local affections, whether as regards their extent or their seat, are so unimportant that, in themselves, they do not essentially disturb the functions and the nutrition of the tissues, nor greatly interfere with the result of a general course of treatment for the improvement of substance, a result which depends on a certain soundness of the functions; in the other case, on the contrary, the local affections are so disturbing and threatening, that they not only impede nutrition and the formation of blood, but they even paralyse the effect of a course of treatment designed to influence the change of substance. In the first case, methods producing a general effect, and these *only*, are indicated, such as country life, well-regulated diet, stimulation of the stomach by tonic remedies, sool-baths, sea-baths, and gaseous sool-baths, according to the greater or lesser impairment of the powers of nutrition. These remedies promote the change of substance, and with it the absorption of the slight exudations, which even in themselves, but little, or not at all, disturb the nutrition. Foremost of all stands *sea-bathing*, the ideal of all modes of treatment for promoting change of substance and nutrition; yet this requires good functions of assimilation, and a constitution which can bear the shock of cool and greatly agitated baths. A milder effect is produced by *sool-baths*, which promote the change of substance without making these greater demands on the organism; and between the two remedies stand *the gaseous thermal sool-baths of Rehme and Nauheim*, the strongly stimulating effect of which produces a result similar to that of sea-bathing. In the second case, where the *rapid absorption of exudations* is required, especially in a great number of lymphatic glands, when by impeded lymphatic circulation the excretion of used-up tissues and the supply of digested nourishment is so considerably hindered that from this local cause nutrition is much lowered, the above-mentioned remedies are of no avail, because their general effect is prevented by the local affections. To treat these cases with an ordinary course of sool-baths,

Absorption of
serofulous
exudations.

sea-baths, or thermal baths at Rehme, is quite useless, until the glandular exudations are diminished by an absorbent treatment to such a degree as to permit a better circulation of lymph.

As a means for producing so strong an absorption, the following have been found efficacious: 1, the internal use of moderately aperient *common salt waters*; 2, mild but continued courses of *Carlsbad water*, which deserves more frequent use in scrofulous exudations than it habitually enjoys; 3, strong lixiviating *cold water* and *thermal treatment*; 4, the internal use of *iodine*, especially in combination with *sool-baths*, or other baths of some duration.

Only a few cases of this class of scrofulous diseases are suited for the *strong thermal treatment* of very warm and prolonged baths, although these cases belong to the so-called *torpid form*; the strong stimulant of heat generally produces such violent irritation as is rarely borne in the low state of nutrition, and the torpid form of disease is changed into the erethic. On the other hand, the thermal mode of treatment is frequently and with tolerable success used for adults with whom a great part of the cervical glands is enlarged, although even then, in severe cases, a cure is alone to be expected from the knife.

The *cold water system*, used in as vigorous a manner as the promotion of considerable absorption requires, likewise lies in most cases beyond the capability of the organism, and from its use, as with that of the severe thermal system, the congestion of the internal organs is always to be feared.

Courses of common salt waters and Carlsbad water, if taken with regard to individual circumstances, are almost always bearable, and very often, combined with *sool-baths*, fulfil the object of stimulating the absorption and the lixiviating change of substance. Leaving further details to the third book, we will only here observe that the effect of both kinds of waters is about the same, namely, stimulation of the peristaltic motion and the intestinal secretions, increase of the secretion of bile, supply of soda to the blood for the maintenance of its

Schmal-
kalden.

Schmalkalden, on the Thuringian forest, 1,000 feet above the level of the sea, possesses a sool-spring of 80 grains of chlorides, thus somewhat more than 1 per cent.; it furnishes, therefore, very weak sool-baths, and it is not much adapted for courses of drinking, as it contains 22 grains of sulphate of lime. Station: Wernshausen, on the Werra railway. (Drs. Fuchs and Wachenfeld.)

Homburg.

Homburg, railway station, half-an-hour from Frankfurt-on-the-Maine, contains springs which are somewhat richer than those of Kissingen in chlorine combinations, carbonic acid, and iron; and hence, as regards drinking, they are used for much the same class of cases as Kissingen. As the carbonic acid is in a great measure lost by the heating of the very cold water, the bath containing 95 grains of chlorine combinations, equal to $1\frac{1}{4}$ per cent., may be regarded a very weak sool-bath with a small quantity of carbonic acid. See the description of the place in the third book.

Wies-
baden.

Wiesbaden, capital of the former duchy of Nassau, with 36,000 inhabitants, combines all the comforts and discomforts of grand bath and foreign intercourse, and affords at the same time opportunity for the most luxurious as well as for the simplest and cheapest taste. The climate is mild, the winter one of the warmest in Germany, the spring and autumn often beautiful, but the midsummer is hot and relaxing. It is situated 323 feet above the level of the sea. The baths are on the basement floor of 20 lodging-houses and hotels, and are supplied direct from the springs. These springs are natural thermæ of more than 62° Cent. (143·6° Fahr.), and require, therefore, to be cooled for bath use. The important internal use of the springs will be mentioned in the following book; for outward application they are scarcely more than indifferent thermæ, containing 45 to 58 grains of chlorine combinations, equal to $\frac{3}{8}$ or $\frac{1}{2}$ per cent., besides a slight amount of carbonic acid; and they are consequently adapted for the symptoms which we have already discussed as suitable for these baths, and especially for Teplitz, with the one qualification, that the water, weak as it is, contains sufficient chlorine salts to contra-indi-

cate its use, according to Hebra's caution, in cases of irritable exanthemata, and especially in eczema. The well-proved effect of Wiesbaden in cases of stomach catarrh, stasis of the bowels, and occasionally in gout, is to be ascribed to *drinking the waters*; the effect upon rheumatic diseases, paralyses, and also upon gout, is to be imputed to *the thermal baths*, and is to be estimated according to the principles of the thermal system. The recent removal of the public gaming table will render Wiesbaden, as it deserves to be, one of the most beautiful, amusing, and effective baths, rivalled but by few in its ability to satisfy all requirements, both the simplest and the most complicated, and in the excellent arrangements for the use of its waters. There are also two cold water establishments, and the private ophthalmic hospital of Drs. Pagenstecher. [Amongst the numerous medical men we may mention Drs. Fritze, Genth, Haas, senior and junior, Heymann, Hoffmann, Mahr, Mackower, A. and H. Pagenstecher, Velten, and Wibel.]

Bourbonne-les-Bains, in France, on the acclivity of the Vosges mountains, is the French Wiesbaden, both with regard to the contents and temperature of its springs, and their application. [The little town lies in the department Haute-Marne, near the station Laferté, on the Paris-Muhlhausen line, about 900 feet above sea-level. The temperature of the different springs averages between 115° and 147° Fahr.; the usual temperatures of the baths between 95° and 97·5°.—Drs. Balley, Bougard, Cabasse, Causard, Magnin, Rénard.]

The *Adelheid* spring, in the village of Heilbrunn, among the Bavarian lower Alps, 2,400 feet above the level of the sea. The iodine effect of this spring has been discussed at page 230. When the quantity of water taken at the spot reaches 60 or 70 ounces per day, the 38 grains of common salt contained in every pound of water, together with some free carbonic acid, must have a greater effect than the very small quantity of iodide of sodium. The baths, containing $\frac{1}{2}$ per cent. of chloride of sodium, only possess the value of an artificial but highly situated thermal spring, and afford the enjoyment of Alpine air,

combined with a cheap and simple mode of life. (Dr. Höfler at Tölz, and Dr. Vogel at Bichel).

Wildeg. *Wildeg*, in Switzerland, near Schingnach, possesses a bored sool-spring containing 95 grains of chlorine combinations, or $1\frac{1}{4}$ per cent. [Elevation above sea, 1,100 feet. (Drs. Amster and Hemmann.)]

Sulzbrunn. *Sulzbrunn*, one hour from Kempten (station on the Bavarian Southern Railway), situated among the Bavarian Alps, 2,670 feet above the level of the sea, is specified also as a common salt-spring in all compendiums. Containing an amount of 16 grains of chlorine combinations, or scarcely $\frac{1}{4}$ per cent., the baths possess no further importance than that of any indifferent artificial thermæ enjoying a tolerably high mountain position. The waters of Sulzbrunn enjoy also the reputation of being iodine waters; but the iodine can scarcely be said to have any appreciable effect, on account of the smallness of the proportion. (Dr. Hertel.)

Mondorf. *Mondorf*, in the Grand Duchy of Luxemburg, three hours from the town of Luxemburg, 600 feet above the level of the sea, possesses a spring containing 106 grains of chlorine combinations in 16 ounces, or $1\frac{1}{2}$ per cent., and accordingly furnishing weak baths, which, however, may be regarded as sool-baths. The amount of 12 grains of sulphate of lime contained in the spring is moderate enough to allow of its being used for an internal course of waters; the spring, moreover, contains 0.47 volume of nitrogen gas, a quantity which amounts to the tenth and twentieth part of that contained in the springs at Lipp-springe and Inselbad, near Paderborn, and the effect of which is more than problematical. (Dr. Schmit.)

Iwonicz. *Iwonicz*, in the Sanok district of Galicia, possesses a spring containing 47 to 60 grains of chlorine combinations, and a considerable amount of free carbonic acid (27 to 30 cubic inches), which, however, is for the most part lost in the heating of the very cold water. Yet the water, on account of its amount of gas and of carbonate of soda (8 and 13 grains), and the absence of sulphate of lime, is adapted for a course of drinking, like Kissingen and Homburg.

Among the stronger sool-baths in Poland, passing over several very small and primitive establishments, we name the following: *Bolechow*, *Ciechocinek*, *Druskiemniki*, *Rabka*, and *Busko*.

[Amongst the weaker sool or salt-baths we may mention those of *Harrogate*, in Yorkshire; although, on account of the sulphide of sodium and the sulphuretted hydrogen contained in the principal springs, they will find also a place amongst the sulphur-waters. There is a considerable variety in the constitution of the different springs of Harrogate; if we leave out of question, at present, the chalybeate springs, we find, according to Dr. Hoffmann's analysis, that of the three principal saline sulphur-springs, the 'Old sulphur-well' contains 866 grains of common salt in the gallon of water, the 'Montpellier strong sulphur-well,' 803 grains, and the 'Montpellier mild sulphur-well,' only 232 grains. There are some points of resemblance between the Harrogate waters and those of Kissingen; but the former contain more lime and less carbonic acid, by which they are rendered rather less digestible when taken internally, and less stimulating when used as baths. Kissingen has besides, for bathing purposes, the advantage of the graduated sool, for increasing the strength of the baths according to the necessity of the case. The climate of Harrogate is, however, much more bracing. (Drs. Bealey, Myrtle, and other medical men practising at Harrogate.)]

Harrogate.

[Another important English spa, which finds its proper place among the sool-waters, is *Woodhall*, situated between Boston and Lincoln. It is known by the name of the 'Iodine Spa;' but the iodine plays probably as secondary a part in the action of the Woodhall water as it does in that of the 'Haller Iod-Wasser,' or of the 'Adelheidsquelle,' or the other so-called iodine waters. According to Mr. Cuffe's pamphlet on the Woodhall Spa, a gallon of the water contains 1,215 grains of chloride of sodium, 105 of chloride of calcium, 86 of chloride of magnesium, and rather more than 5 grains of bromide of sodium, and more than $2\frac{7}{10}$ grains of iodide of sodium. Reducing this roughly, we may say that 16 ounces contain 120 grains of

Woodhall.

common salts, 21 grains of other chlorides, $\frac{1}{2}$ grain of the bromide, and over $\frac{1}{4}$ grain of the iodide of sodium. Delicate children take one or two ounces twice a day, and in this quantity $\frac{1}{16}$ to $\frac{1}{4}$ grain of bromide, and $\frac{1}{30}$ to $\frac{1}{7}$ grain of the iodide in the 24 hours. We are, therefore, inclined to ascribe the effect of the Woodhall waters to the chlorides and other conditions, rather than to the iodide and bromide.]

[Some of the hot springs of *Ischia* may likewise be quoted here, as also some salt springs at *Castellamare*, those at *La Porretta*, at the foot of the Apennines, at an elevation of over 1,000 feet, and at *Monte Catini*, between Pistoja and Lucca. Italy is, on the whole, rich in mineral springs, but the medical and other arrangements at most places are as yet scarcely such as to encourage English doctors to send many delicate invalids to Italian baths.]

b. *Stronger sool-baths, or weaker, which, however, afford means for concentration on the spot.*

Kreuz-
nach.

Kreuznach, in the Nahe valley, 286 feet above the level of the sea, in a pleasing situation and possessing a mild climate, with an early spring and late autumn, but occasionally hot summer, is the chief of sool-baths. The abundance of the springs, which belong partly to the town and partly to the salt-works of Carlshalle, Theodorshalle, and Münster am Stein; their drinkable character, the possibility of strengthening them with refined sool, mother-lye, and bath-salt; the excessive belief in the effect of iodine and bromine; the climatic conditions; the agreeableness of the place, and the well-adapted method of treatment,—all these form the combination of circumstances upon which the well established reputation of this bathing resort rests. *Kreuznach* is a typical model as regards the mode of treatment and the internal and external application of sool-springs, and for this reason we give an analysis of the springs, on the minute component parts of which, it is true, little or nothing depends, but which may serve as a specimen, and may be useful for comparison with others.

In 16 ounces are contained—

Temperature.	Eisen- quelle. 8° R.	Oranien- quelle. 10° R.	Carls- halle. 19° R.	Theo- dors- halle. 17° R.	Münster am St. 24°5 R.
Chloride of sodium . . .	72·883	108·705	59·665	57·191	60·998
Chloride of calcium . . .	13·389	22·760	2·561	14·707	11·083
Chloride of potassium . . .	0·624	0·460	0·407	0·012	1·342
Chloride of magnesium . . .	4·071	—	0·678	4·416	1·471
Chloride of lithium . . .	0·631	traces.	0·056	0·039	—
Chloride of aluminium . . .	—	—	0·432	—	0·018
Chloride of manganese . . .	—	—	0·653	—	—
Bromide of magnesium . . .	0·278	1·780	1·367	—	0·663
Bromide of sodium . . .	—	—	—	—	—
Bromide of calcium . . .	—	—	0·602	—	—
Iodide of magnesium . . .	0·035	0·012	—	—	—
Iodide of sodium . . .	—	—	0·044	0·031	0·0004
Carbonate of lime . . .	1·693	0·255	0·613	2·149	1·123
Carbonate of baryta . . .	0·017	—	—	—	—
Carbonate of magnesium . . .	—	0·130	0·473	0·199	—
Carbonate of protoxide of iron . . .	—	0·356	0·364	0·218	0·034
Oxide of iron . . .	0·164	—	—	—	—
Protoxide of manganese . . .	0·806	—	—	—	—
Silica . . .	0·129	0·096	0·031	0·099	0·007

The sool of Münster am Stein, refined to 14 per cent., contains—

Chloride of sodium	927	grains
Chloride of calcium	155	„
Chloride of magnesium	12	„
Chloride of potassium	19	„
Bromide of sodium	9·7	„
Iodide of sodium	0·005	„

The mother-lye is variously composed, according to its degree of inspissation ; for instance :

	According to Polstorf.	According to Mohr.
Chloride of sodium . . .	226 grains.	122 grains
Chloride of calcium . . .	1,789 „	2,014 „
Chloride of magnesium . . .	230 „	287 „
Chloride of potassium . . .	168 „	130 „
Chloride of aluminium . . .	1·5 „	— „
Chloride of lithium . . .	7·9 „	— „
Bromide of sodium . . .	59 „	65 „
Iodide of sodium . . .	0·05 „	Traces.

Mother-lye-salt :

Chloride of sodium	106	grains
Chloride of calcium	2,981	„
Chloride of magnesium	444	„

Mother-lye (*continued*)—

Chloride of potassium	362 grains
Chloride of aluminium	9 "
Bromide of sodium	246 "
Iodide of sodium	65 "

The natural springs of Kreuznach, according to the above analysis, afford for courses of drinking, which we will more fully discuss in the next book, waters containing a medium amount of salt, viz.: 63 to 132 grains of chlorine combinations to 16 ounces, or 0·8 to 1·7 per cent.; at the same time there is an utter absence of sulphates, and thus the effect on the mucous membrane of the stomach and intestines remains moderate. The amount of salt is, however, always strong enough to limit the beneficial effect to smaller doses, for adults not more than 24 to 30 ounces a day, and for children not more than 12 to 16 ounces. With the latter quantity a scrofulous child would therefore take, in the Elisenquelle, 0·035 grains of iodide of magnesium, and in the Oranienquelle 0·012 grains of the same; in the water of the Carlshalle 0·044 grains of iodide of sodium, in the Theodorshalle 0·031 grains of the same; and in the various springs 0·278, 1·780, 1·367, 0·663 grains of bromide of magnesium. In many cases, however, these daily doses of iodine and bromine are considerably diminished, if smaller quantities of the waters be taken; in others, when the aperient effect preponderates, a part of them is at any rate removed with the fæces. And thus we are well justified in casting a doubt upon the strong value attached to the effect of the iodine and bromine in the Kreuznach springs, and we revert here once again to this matter, because the high opinion as to the effect of iodine waters, still here and there entertained, emanated first of all from Kreuznach.

Mode of
treatment
at Kreuz-
nach,

The internal use of waters, which in Kreuznach is almost universally combined with the use of baths, increases the effect of the baths in promoting absorption, and forms an essential part of the mode of treatment which has procured this bathing resort its reputation, especially as regards scrofulous exudations. The Kreuznach *bath system* also inclines predominantly to strong baths, with

an addition of mother-lye of as much as 10 quarts, by which the bath is strengthened $1\frac{1}{2}$ per cent., or protracted baths of three-quarters or a whole hour long; in a word, that mode of treatment is predominantly in use in Kreuznach, the indications for which we have already pointed out with regard to one mode of antiscrofulous treatment (page 203), namely, that which aims at the strong promotion of absorption. And this is the point of view by which the choice between Kreuznach and the gaseous thermal sool-baths of *Nauheim* and *Rehme*, for the more serious cases of scrofula, is to be estimated. The choice between the two is in no wise arbitrary, but is regulated according to the importance of the local affections. The more recent and the less extensive the local deposits are, and the less important they are compared with the low state of nutrition, the more are the stimulating thermal sool-baths of *Nauheim* and *Rehme* indicated: the more urgently, however, that extensive, and, from their seat, alarming exudations require to be removed, the more Kreuznach or the Kreuznach system deserves the preference. If, therefore, in the prevailing confusion of the indications, we must recommend Kreuznach in the first place for many a case which is assigned to Rehme, we should select Rehme for a subsequent course of treatment in many cases in which Kreuznach has fulfilled its requirements. As in many cases at first only one of the two baths is indicated, so in the individual case there is often a time when the one must give place to the other. This explains those apparently confusing experiences, when the result of the second year fails to correspond with that of the first, just because in the second year another mode of treatment was required than in the first. Another confusion arises from the fact that the result of the two baths is often similar in similar cases; this is, however, the medium class of cases, in which Kreuznach, as a sool-bath, produces much the same effect as Rehme does as a sool-bath and as a gaseous thermal bath.

Choice
between
Kreuznach
and
Rehme.

The short notices which we adduce with regard to the various sool-bathing resorts, are designed to decide the

Choice of
different
sool-baths.

question for the practitioner in any individual case. As to the manner in which one of the two sool-bath modes of treatment can be fulfilled in any bathing resort—i.e., either the moderately stimulating mode of treatment, promoting change of substance and nutrition, or the strongly stimulating mode, intended to produce a powerful absorption—the former intention can be fulfilled at Kreuznach, in addition to the preponderating latter one; and equally well can the Kreuznach system be pursued at other bathing resorts, if the sool-baths of the place be combined with a drinking course of transmitted or artificial mineral waters. Besides those to be mentioned, there are a number of smaller local sool-baths, which may be applied to the same use, according to the same principles. For the internal use of sool-waters, the three following rules may be taken as the result of experience. 1. An amount of sulphate of lime of more than 15 or 18 grains in 16 ounces renders the water difficult of digestion; 2. The amount of iron in stronger sool-waters, especially when without carbonic acid, is indifferent, because the iron under these circumstances for the most part passes away with the increased and quickly ejected fæces; 3. For courses of drinking, in which not merely the increase of the intestinal secretion is aimed at, but also the absorption of the chloride of sodium, an amount of 100 grains of chlorine combinations is about the limit which must not be much exceeded for this purpose.

Next to the consideration of the remedies and the arrangements existing on the spot, the climatic conditions of the place claim attention, and we refer the reader to the first book for our remarks upon this subject. No such essential diversities occur among most sool-baths with regard to height of situation, as to form a basis for any fixed differential indications. Only a few, such as Kreuth, Aussee, Hall in Tyrol, and Traunstein, have such a high subalpine situation, as to make the choice of them, as compared with others, resemble that of the highly situated natural thermal baths compared with the lower lying indifferent thermæ. Frequently we meet on this subject with an error which confounds the idea of a *warm* climate with

that of a *non-stimulating* one. A remarkably high situation, possessing moderate summer temperature, does not indicate an exciting climate, but one which moderates excitement, and therefore more readily allows the use of exciting forms of baths than low situations combined with great summer heat; hence we find at Kreuth, more than at any other sool-baths, the most excitable natures and the so-called florid forms of scrofula. Of course the influences of the change of temperature upon susceptible individuals have also to be taken into account, and, moreover, the season of the year at which the baths are used; for instance, for a course of baths in the autumn and early spring, the preference would be given to the warm and equable climate of Kreuznach in many cases in which, for a mid-summer course, the mountain bath would be selected; and it is for this reason that, in enumerating the stronger sool-baths still to be mentioned, we have placed them according to the height of their position.

Kreuth, 2,911 feet above the level of the sea, in a *Kreuth*, very sheltered situation, amid grand Alpine scenery, possessing a pure and moist air, four hours from the Holzkirchen station on the Munich and Salzburg railway, is, from its climate, its arrangements, and its remedial resources, one of the most efficacious baths for irritable, scrofulous, and even tuberculous natures. The invalids reside in the Kurhaus (200 rooms), the easily heated corridors of which are connected with the drinking-halls and bathing apartments. Comfort and amusement, and even musical entertainment, are combined with moderate prices. All the ordinary mineral waters are purchasable.

Remedial Resources.—1. One of the best whey establishments.

2. The juices of herbs, prepared from nasturtium aquaticum, trifolium fibrinum, taraxacum, and veronica beccabunga.

3. The sulphur-springs of the Holy Cross, used for drinking, 11° Cent. (51·8° Fahr.)

Sulphate of lime	8.50 grains.
Sulphate of magnesia	11.00 "
Carbonate of lime	7.25 "
Carbonate of magnesia	2.50 "
Carbonate of protoxide of iron	0.25 "
Chloride of magnesium	0.50 "
Silica	1.50 "
Sulphuretted hydrogen	0.2 "

4. Sool-baths, increased to the concentration desired by the sool and mother-lye of Rosenheim.

[A great advantage of Kreuth is the remarkable calmness of the atmosphere, caused by the position of the surrounding mountains and woods. At repeated visits, the editor found the air at Bad Kreuth almost perfectly still, while there was a tolerably high wind at other places scarcely a mile distant. To this circumstance we ascribe the remarkable improvement often effected at Kreuth in consumptive conditions, associated with irritability of the respiratory mucous membrane and tendency to bronchitis. The immediate neighbourhood of beautiful forests is another advantage, not only by its influence on the state of the oxygen, but also because it enables the invalids to spend almost the whole day in the open air without exposing themselves to the heat of the sun, or to wind. The accommodation, though good, is unfortunately limited, and the bath-rooms are often already engaged in January for July and August, while in June and September, which are likewise favourable months, the number of visitors is comparatively small. (Dr. Stephan).]

Aussee.

Aussee, in Styria, 2,074 feet above the level of the sea, six hours from Ischl, a small and quiet sool-bathing resort, splendidly situated. [Aussee may also be reached from the station of Lietzthal. It possesses also a whey establishment; and at a short distance in a sheltered situation, close to a pine forest, is Dr. Schreiber's hydropathic establishment and sanatorium.—Drs. Pohl and Schreiber.]

Hall, in the Tyrol.

Hall, in the Tyrol, situated in the valley of the Inn, 1,700 feet high, two hours from Innsbruck, with a station on the Munich and Innsbruck railway, and surrounded with grand Alpine scenery, possesses a bath establishment in the village of Heiligen Kreuz, a quarter of an hour

from the town. The lixiviated sool contains 1,975 grains of chlorine combinations to 16 ounces, equal to 26 per cent.; it may therefore be regarded as mother-lye, and it has to be diluted for the baths. Climate very mild. (Dr. Stolz.) In the vicinity is *Gnadenwald*, 2,700 feet above the level of the sea, a good summer residence for invalids and convalescents requiring care. Life simple and quiet, though not without variety, owing to the vicinity of Innsbruck and Hall.

Traunstein, in the Bavarian part of the Salzburg Alps, 1,784 feet high. Smaller bathing establishment, supplied by the sool of Reichenhall. Traunstein.

[*Aibling*, the Albeanum of the Romans, about 1,700 feet high, likewise in the Bavarian highlands, is a rising place.—Dr. Von Stransky.]

Ischl, in the Salzkammer district, elevated about 1,500 feet, in grand Alpine situation, possessing a very mild and equable climate, is one of the most frequented and fashionable baths, which, however, offers also accommodation for modest pecuniary resources. The climate is especially efficacious for invalids of a susceptible chest. Ischl.

Remedial resources: 1. Whey establishment; 2. Mud-baths and sool-vapour-baths; 3. Sool-baths, for which the 23 per cent. sool has to be diluted; generally speaking, stronger baths (4 to 5 per cent.) are used.

[*Ischl*, which will soon be connected by rail with the Salzburg-Vienna line, owes the peculiarly soothing influence of its climate, especially on irritable mucous membranes, to the manner in which the place is surrounded by high mountains. Hence the atmosphere is generally calm and moist. The principal portion of the town is in a rather low position, near the river Traun, and in the immediate neighbourhood of the bathing establishments, and in this part some invalids feel oppressed; but a few villas of late have been erected on the slopes of the surrounding hills, and an increasing appreciation of the value of fresh air will, no doubt, lead to farther progress in this direction. The well-managed hotel Bauer on the hill, gave the first start to this movement. All the foreign mineral waters are to be obtained at *Ischl*, and a hydro-

therapeutic establishment is close to the town.—Drs. von Brenner, Furstenberg, Heinemann, Kirschfeld, and Kaan.]

Reichen-
hall,

Reichenhall, 1,407 feet high, with the bath establishment of Achselmannstein, resembles Kreuth in its climatic conditions, though much lower in situation. It is connected by railway with Salzburg and Munich, and is one of the best sub-Alpine baths. The sool is much concentrated, in some parts to 23 per cent., and it has therefore to be diluted. The sool is also used for drinking, of course diluted, $\frac{1}{2}$ to $1\frac{1}{2}$ ounces in a glass of water. When, however, as is here unfortunately the case, an effect is ascribed to the bromine, such a claim cannot be admitted; 16 ounces contain $\frac{1}{2}$ of a grain of bromide of magnesium; in $\frac{1}{2}$ and $1\frac{1}{2}$ ounces, therefore, there is $\frac{1}{40}$ and $\frac{3}{4}$ of a grain! Besides the sool-baths, there is a whey establishment. Living has hitherto not been dear, and the medical superintendence is careful. (Drs. Cammerer, von Geeböck, Hess, von Liebig, Packmeier, Schneider, Solger.)

Bex.

Bex, station on the Lausanne-Sion line, in the Canton Vaud, 1,380 feet high, with a very mild and refreshing climate, except in the hot summer months, and a strong lixivitated sool, which is diluted for bath use. Within the last two years, an hotel of the first rank has been opened in the neighbourhood, possessing excellent arrangements, and in an extremely beautiful situation, but with very high prices. (Dr. Cossy.)

Rosen-
heim,

Rosenheim, 1,356 feet high, at the junction of the Munich-Salzburg with the Innsbruck railway, situated in the broad valley of the Inn, and within reach of splendid Alpine scenery, possesses a new and flourishing sool-bath, which receives the concentrated sool from the salt-works of Reichenhall, besides a sulphur-spring. (Drs. Halbreiter and Schelle.)

Hall.

Hall, in Austria, 1,064 feet high, about eight English miles from the station Steyer, on the branch line from Linz to Rottenmann, in an agreeable and mountainous situation, has recently come into fashion as a well arranged sool-bath ($1\frac{1}{3}$ per cent.). From an early period this has been used internally as 'Kropfwasser' (Goitre water), and is much employed for the sake of the iodine,

under the name of the 'Hall iodine water.' It contains 0·448 grain of bromide of magnesium, and 0·327 of iodide of magnesium in 16 ounces. It is given in doses of 1 to 6 ounces, or about $\frac{1}{32}$ to $\frac{1}{4}$ of a grain of bromide of magnesium, and $\frac{1}{8}$ to $\frac{1}{4}$ of a grain of iodide of magnesium. That these small doses, *taken for several months*, may produce an effect, is certainly not to be disputed; that, however, in shorter courses of treatment, they cause symptoms of iodism, may have occurred in rare cases, but can scarcely be regarded as a general result, judging from our experience as to the use of pharmaceutic preparations of iodine and bromine. (Dr. Rabel.)

Arnstadt, in the Thuringian forest, 900 feet high, a town of 6,000 inhabitants, and one of the most favourite North German summer residences on account of its beautiful climate and woody situation, affords the visitor all that is necessary for a pleasant and social country life, and all the remedial resources which are requisite to the effect of sool-baths. The sool, as in most salt springs, is not without the usual element of iodine and bromine; and although this is not much less in amount than in the Hall iodine water (0·39 and 0·17), iodism has never been observed at Arnstadt. The sool contains 1,812 grains of chlorine combinations in 16 ounces; it is therefore 23 per cent., and has to be diluted for baths. The mother-lye is double as strong. For courses of drinking, the *Riedquelle* of Plaue is employed, a mild salt water which, owing to a moderate amount of carbonic acid, is easily digestible. It contains in 16 ounces—

Chloride of sodium	26·10 grains.
Chloride of potassium	0·02 "
Chloride of magnesium	0·50 "
Sulphate of lime	3·24 "
Sulphate of soda	1·52 "
Sulphate of magnesia	0·72 "
Carbonate of lime	1·00 "
Carbonate of magnesia	0·04 "

Whey is also to be had, besides pine-wood baths. Arnstadt is a station on the Thuringian railway. (Drs. Niebergall and Oswald.)

Hubertus-
bad, near
Thale.

Hubertusbad, near Thale, 800 feet high, at the termination of the Bodethal, in the Hartz mountains, with a railroad station, has a mild and fresh summer climate, and affords a pleasant country life. The spring contains 200 grains of chlorine combinations to 16 ounces, or $2\frac{1}{2}$ per cent., and furnishes a sool-bath of medium strength. (Dr. Scabel.)

Goczalko-
witz.

Goczalkowitz, 800 feet, situated in the neighbourhood of Pless, in Upper Silesia, is a newly established bathing resort, of great importance to the province of Silesia, which is poor in salt-springs. (Dr. Babel.)

Königs-
dorf.

Königsdorf Jastrzemb, 800 feet high, in Upper Silesia, near the railway stations of Petrowitz and Rybnik, is also recently established. The sool has 95 grains of chlorine combinations, or $1\frac{1}{4}$ per cent.; it therefore affords a weaker sool-bath, but a drinkable spring. (Dr. Faussel.)

Salzungen.

Salzungen, 778 feet, in the duchy of Meiningen, on the Werra railway, a town of 3,000 inhabitants, affords, like Arnstadt, all the requirements for a good sool-bathing resort—namely, mountain and forest air, abundant opportunity for reasonable and good accommodation in the bathing house, in hotels, and numerous private houses, agreeable promenades, and a large supply of plentiful and strong salt-springs, containing from 28 to 30 per cent. of chlorine combinations, and mother-lye at 30 per cent. Generally speaking, *strong* sool-baths are taken, as is the case in most of those bathing resorts where there is no lack of an abundant supply of concentrated sool. The sool for drinking contains 91 grains of chloride of sodium, 10 grains of chloride of lime, 1·7 grain of chloride of magnesium, scarcely 2 grains of sulphate of lime, and it is plentifully impregnated with carbonic acid. The apparatus for inhaling air impregnated with saline vapour is peculiar; the building where the graduation is effected is supplied with *saturated* sool, and is covered with a roof, and surrounded with glass walls, so that the invalids are protected from rain and draughts. (Drs. Wagner and Ley.)

Harzburg.

Harzburg, called as a bathing resort *Juliusshall*, is 706 feet high; it is a station on the Brunswick-Hartz rail-

way, with a fresh summer climate. It possesses a whey establishment and sool and pine-wood baths, and abundant accommodation. (Drs. Dankworth and Meyen.)

Hall, in Würtemberg, 665 feet high, connected by railway with Stuttgart and Heilbronn, is situated in the Kocherthal. The climate is mild; the sool has 2 per cent. of chlorine combinations, and can be strengthened. (Dr. Dürr.)

Hall, in
Würtem-
berg.

Jaxtfeld, a small sool-bathing resort in the Neckar valley at the mouth of the Jaxt, containing sool and strong mother-lye at 25 per cent.

Jaxtfeld.

Rottweil, on the upper course of the Neckar, with sool of similar strength.

Rottweil.

Kissingen, 590 feet—which will find its proper place of mention when we come to the discussion of the common salt springs for internal use (see p. 401)—may be so far reckoned among sool-baths as its strongest spring of almost 2 per cent., the ‘Soolsprudel,’ is used for baths, and, moreover, refined sool is to be found there. Still, we must expressly declare against the manner in which the Sprudel-baths are usually given. It has been proved by the experience of Rehme and Nauheim, that, to produce the positive effect of the carbonic acid, a moderate bath-temperature is the necessary condition, and that a very considerable amount of carbonic acid, through the inhalation of gas, which is abundantly given off, may be pernicious and poisonous. Such an excessive amount of gas is possessed by the Soolsprudel ($30\frac{1}{2}$ cubic inches to 1 pound), and the effect of the inhaled carbonic acid very speedily makes itself felt in the bath; hence at Kissingen not only is the bath-temperature not readily allowed to exceed 25° Cent. (77° Fahr.), but very often the baths are taken at the natural temperature of 20° Cent. (68° Fahr.), and besides full baths, the agitated forms of jet-baths and wave-baths are used. At this temperature, however, and in these forms, the mode of treatment cannot be regarded as belonging to the sool-bath system, but only to the modified cold water system, combined with the pernicious inhaling of carbonic acid; and even when the temperature of the baths rises to 26° Cent. (78·8° Fahr.)

Kissingen.

the highest used there, the amount of the gas in the air (the heating rendering its escape still more active) is so great, that the consequences of its inhalation for the most part rapidly show themselves in giddiness, dyspnœa, and other symptoms. The carbonic acid is beneficially stimulating in its effect, only when it is admitted through the skin, and it is all the more injurious the more the lungs participate in its reception; hence at Rehme and Nauheim quiet baths are the main object of all the arrangements. If all inhalation of carbonic acid could be prevented in a sool-bath containing gas, the contra-indication would in many cases cease; direct arrangements, however, to affect this inhalation are opposed at once both by theory and by practice. With the movement of the water and the bubbling forth of the gas, the ignorant readily connect the superficial and mechanical idea of a greater medicinal virtue, and they do not reflect that that which thus by its increase produces an effect, is just the undesired and pernicious side of the influence at work.

In Rehme also the belief had established itself that agitated baths were stronger, because the sensorium was more affected by the inhalation of the ejected carbonic acid, which thus is lost in the bath-water, and it required a long time to eradicate this prejudice.

[We are glad to add that the bathing arrangements at Kissingen have during the last years been greatly improved, and that their reputation would be still greater, were it not somewhat eclipsed by the almost unrivalled qualities of the Rakoczy for internal use. The gaseous thermal sool-bath without motion, as used to perfection at Rehme and Nauheim, has no doubt a different effect from the *wave-bath*, or bath with undulation ('Wellenbad'). The former, which is generally used at a medium temperature, allows the invalid to remain in it longer, not only on account of the stimulating effect of the carbonic acid and of the greater warmth, but also because the layer of water in contact with the surface of the body is soon warmed by the latter, and by remaining unmoved abstracts a smaller amount of heat from the body; the carbonic acid has thus more time

to act on the peripheric nerve-ends, and through them on the nerve-centres, a matter of great importance in some diseases of the nervous system. In the wave-bath, which is generally given somewhat cooler, the layer of water near the skin is constantly changed; the abstraction of heat is therefore greater, the bath is of shorter duration, and the carbonic acid has less time to influence the peripheric ends of the nerves, which, however, are greatly acted upon in another way, namely, by the motion of the water. Other advantages of the wave bath, as pointed out by Dr. O. Diruf, senior,¹ are: that the cool saline water entering with great force, equal to the pressure of two atmospheres, from a large opening near the centre of the bottom of the bath, can be used as a douche to various parts of the body, for instance, hæmorrhoidal swellings; and further, that the water of the whole bath is gradually, and to the bather almost imperceptibly, cooled by the colder water entering the bath; and that reaction is thus prepared, and the tendency to chill after the bath diminished. Thus both kinds of baths have different effects, and each possesses peculiar advantages for different classes of ailments.]

Suderode, on the Lower Hartz mountains, 550 feet high, in the vicinity of Gernrode, Quedlinburg, and Thale, is a pleasant summer residence, combining simple and quiet country life and reasonable arrangements. The sool amounts to $2\frac{1}{3}$ per cent., and is therefore adapted for sool-baths of moderate strength, and also, as it contains some free carbonic acid, for courses of drinking. Suderode.

Frankenhausen, 500 feet high, in the principality of Schwarzburg-Rudolstadt, can be reached in two hours from the Rossla station of the Halle-Nordhausen railway; it is situated in the woody and hilly country between the Hartz and the Thuringian forest, near the Kyffhäuser mountain, and it may likewise be numbered amongst the quiet, rural, and very reasonable sool-baths. (Drs. Clemens, Eck, and Kreismann.) Frankenhausen.

Salzhausen, 460 feet high, in the Wetterau, near Nidda, four and seven hours respectively from the Friedberg and Salzhausen.

¹ *Bad Kissingen*, 1873.

Giessen stations, on the Main and Weser railway, is likewise one of the smaller and cheaper sool baths. (Dr. Prinz.)

Pyrmont. *Pyrmont*, 400 feet high, the long-famed bathing resort in the principality of Waldeck, will be further mentioned when we speak of the chalybeate springs. It possesses in addition to these, springs of common salt with 1 to $3\frac{1}{2}$ per cent. of chlorides, which may be still further strengthened by means of the salt-works; also a spring, which, from the considerable amount of carbonic acid and the moderate amount of salt it contains, is adapted for a course of drinking. (See analyses in the following book.)

Sulza. *Sulza*, 380 feet high, in the Grand Duchy of Weimar, station on the Thuringian railway, may be reckoned among the cheap country bathing resorts. The sool contains $2\frac{1}{2}$ to $4\frac{1}{2}$ per cent. of chlorides. (Dr. Beyer.)

Köstritz. *Köstritz*, in the principality of Reuss, a small but recommendable sool-bath; it has also pine-wood baths and sand-baths. (See p. 189.)

Kösen. *Kösen*, 356 feet high, station on the Thuringian railway, an hour from Naumburg, situate in the pleasant and wide valley of the Saal, is one of the most frequented North German sool-baths. The sool contains $4\frac{1}{2}$ per cent. of chlorine combinations, and thus furnishes strong sool-baths, which in many cases are diluted. As regards all other circumstances, Kösen maintains a medium position between country bathing resorts and those possessing modern comforts, and it is much frequented as a summer residence, especially by people from Berlin. (Drs. Grodeck, Rosenberger, and Wahn.)

Dürkheim. *Dürkheim*, 358 feet high, in the Bavarian Rhenish palatinate, situated at the foot of the Haardt mountain, with a railway station, is a very favourite resort for the grape-cure, both on account of its mild climate and its excellent grapes. During the summer the sool-baths have been also frequented for some time, and residence there at that period is very cheap. The place possesses a great number of springs, with from $\frac{3}{4}$ to $1\frac{1}{2}$ per cent. of chlorine combinations, which are strengthened at will for baths by the refined sool obtained from the salt-works. The bath

arrangements are, however, shabby, and unworthy of a place so highly favoured as regards climate and scenery; better establishments are, however, in prospect. (Drs. Herberger, Kauffmann, and Schäfer.)

Wittekind, 300 feet, quarter of an hour from Halle, Wittekind.
in the valley of the Saal, has a sool-spring containing more than 3 per cent. of chlorides, which, however, for the most part is further strengthened with bath-salt (60 per cent.). The arrangements are excellent, the life is cheap and full of amusement. The advantage which Wittekind possesses in some cases over many bathing resorts, consists in the intermixture of country bath-life with the elements derived from the nearness of the university town of Halle. (Dr. Graefe.)

Rothenfelde, near Osnabrück, is a country sool-bath, Rothenfelde.
lately established, but rapidly rising and containing 6 per cent. of sool.

Neundorf, in the county of Schaumburg in the former Neundorf.
electoral principality of Hesse, has, in addition to its sulphur-baths (see these), also established sool-baths, which are supplied from the neighbouring salt-works of Rodenberg. The sool contains almost 6 per cent. of chlorides. Neundorf has the advantages of an agreeable situation, and of all the arrangements of an old-established bathing resort.

Colberg, in Pomerania, situated on the Baltic sea, is Colberg.
of importance to the north-eastern part of Germany. The sool is about 5 per cent. It has a mild summer climate, and shady walks on the sea-shore.

Elmen, situated near the salt works of Schoenebeck Elmen.
and Salze, in the neighbourhood of Magdeburg, is a local and provincial bath, which, putting out of the question the want of mountain air, fulfils, as regards arrangements, amusements, and remedial resources, all the demands of a good sool-bath, combining with them simple and reasonable living. (Drs. Albrecht and Lohmeier.)

Besides these, there are in Germany and other countries many other small sool-baths, for the enumeration of which a compendium has no space, but which may be turned to account with the same result as those named, if used

according to the principles and experiences laid down, and according to their remedial resources and arrangements.

SALINE AIR

(Produced in buildings for the graduation of sool).

Saline air. In most sool-bath resorts, which are connected with salt-works, there are to be found so-called buildings for graduation (Gradirhäuser), i.e., large, high, and extensive scaffoldings of faggots of twigs, in which the sool falls in drops from twig to twig, in order to lose a portion of its water and its ferruginous and calcareous salts, and thus, in a stronger degree of concentration, to be carried to the salt-works. The air in these buildings for graduation is accordingly, on account of the evaporation, moist and cool, and is also mixed with very trifling quantities of suspended particles of salt, smelling here and there of bromine. A specific medicinal virtue for tubercles of the lungs has frequently been ascribed to it, and even at the present day great importance is placed on its efficacy for persons of delicate lungs. The truth of the matter is, that the moist and cooler air facilitates respiration in catarrhal affections of the lungs, and exercises a cooling and calming effect on nervous patients in seasons of great heat. Although, therefore, saline air thus produced (Gradirluft) is an agreeable dietetic addition to bath treatment, we cannot ascribe to it that specific virtue which the literature specially devoted to the subject of sool-baths assigns to it. It is possible, of course, that *prolonged sojourn* in such suitable contrivances as we have mentioned in our remarks on Salzungen may produce tangible results. [Possibly the process of evaporation has an ozonising effect on the surrounding air, and may, through this, exercise a favourable influence on chronic catarrhal conditions.]

CHAPTER II.

THE GASEOUS THERMAL SOOL-BATHS OF REHME AND
NAUHEIM.

Carbonic acid, when it is introduced into the stomach, partly produces an effect as a local stimulus on the mucous membrane of the stomach, and partly either as a stimulating or a quieting remedy upon the nerves of the stomach, exciting the peristaltic action of the stomach and bowels, and exercising, when absorbed in a moderate quantity by the veins of the stomach, a transient stimulation of the sensorium, which may be compared to the feeblest amount of the effect of alcohol, and passing away still more rapidly. It has not yet been ascertained what chemical fate the carbonic acid thus introduced into the blood experiences, and how far it influences the chemical processes in the blood. It only exhibits a poisonous effect when it is conveyed direct into the blood, either by injection or by inhalation, or by a great quantity of strongly fermenting liquor, in the latter case by rapid and intense diffusion; while the excess of the gas introduced with gaseous waters is usually removed by the antiperistaltic action of the stomach.

General
remarks as
to the
effect of
carbonic
acid.

The stimulating effect of carbonic acid on places which are bare of epidermis has been long known, and has been made use of in the form of fermenting poultices. That the gas also penetrates the uninjured epidermis, and passes direct into the blood, producing narcotism, has been proved by numerous experiences and various experiments by Abernethy, Collard de Martigny, and others; and consequently it has been frequently attempted, especially after the example of the elder Küster, at Cronthal, to employ carbonic acid as a remedy in the form of gas baths. A comparison of the works on the subject with our own observations upon the gas-baths at Rehme,

confirms the universal experience—an experience which has led to the discontinuance of attempts at such forms of application—that with a slight pressure the gas is either not absorbed at all or only in small quantity, but that with strong pressure it is absorbed in too great a quantity, and leads to symptoms of poisoning, without leaving behind any lasting beneficial results.

At all times the carbonic acid in many baths, both artificially heated ones as well as natural thermæ, has produced an effect upon the skin, and at the same time the effect of the absorbed gas has been also observed, without, however, discerning what part of this is due to the carbonic acid admitted through the skin, and what to that received from the bath atmosphere through the lungs. Moreover, very warm thermæ, especially alkaline thermæ, have been, and are still, cooled in reservoirs before they are conveyed to the baths, and thus they lose the greatest part of the gas; others, such as common salt and chalybeate waters, are previously warmed, and thus a great portion of the carbonic acid passes off into the air. It is a fact that only with the rapid rise of the reputation of the baths of Rehme and Nauheim, which combine a natural and suitable temperature with a strong amount of salt and carbonic acid, more general attention has been paid to the effect of gaseous baths. Whether the large amount of salt in these baths modifies the effect of the carbonic acid and the degree of its absorption, and how far this is the case, might be hard to ascertain; but it is probable that the capillaries of the skin, strongly contracted as they are by the stimulation of the sool-bath, only absorb small quantities of gas, and that the direct effect of the carbonic acid for the most part proceeds from the centripetally transmitted irritation of the peripheric nerves.

The above-mentioned springs of Rehme and Nauheim contain sool-baths with a considerable amount of carbonic acid, 2.2 to 3.8 per cent. of chlorine combinations, and with temperatures varying between 26.5° and 34.2° Cent. (79.88° to 93.56° Fahr.). At both places there are arrangements for regulating the temperature at will, at Rehme by the introduction of hot vapour. For the typical effect

of a single bath, we may take a thermal bath at Rehme of 29° Cent. (84·2° Fahr.).

The annexed table gives the—

Analysis.

Physical and Chemical Properties of the Springs of Rehme and Nauheim.

In 16 ounces.	Rehme (Hoppe, 1860)	Nauheim I.	Nauheim. II.	Nauheim. III.
Chloride of sodium . . .	240·0	265·4	181·2	152·4
Chloride of potassium . . .	—	1·4	4·0	2·0
Chloride of calcium . . .	—	21·9	14·8	13·1
Chloride of magnesium . . .	9·0	3·9	2·6	2·6
Bromide of magnesium . . .	0·01	0·07	0·07	0·08
Sulphate of lime . . .	22·6	0·4	0·3	0·8
Sulphate of soda . . .	25·1	—	—	—
Carbonate of magnesia . . .	1·3	—	—	—
Double-carbonate of lime . . .	8·4	18·2	16·3	14·1
Carbonate of protoxide of iron	0·3	0·3	0·5	0·3
Amount of chloride combinations	240	291	201	170
Per cent. of ditto . . .	3·2	3·8	2·6	2·2
Carbonic acid in 25 cubic feet of sool . . . }	21·2	7·4	13·3	23·5
Temperature in bathing tub . {	28·9 to 30·5° C. (84·2° to 86·9° F.)	34·5° C. (94·1° F.)	31·4° C. (87·52° F.)	(79·7° F.) (26·5° C.)

Effect of a Single Bath.—An ordinary water-bath of 29° Cent. (84·2° Fahr.) in a tub is cool, and is borne only by robust people for any length of time with a general feeling of well-being, and without a gradually increased sense of chilliness. In the thermal sool-bath, also, we observe at first the symptoms of withdrawal of heat: namely, a sense of cold of various degrees, a contraction of the skin combined with increased prominence of the cutaneous follicles, slight stiffness of the limbs, accelerated and small pulse, and occasionally, as the consequence of the inhalation of carbonic acid evolved from the bath, a slight feeling of discomfort in the head and oppression on the chest. After a few seconds, or at the most minutes, however, these symptoms are succeeded by an opposite

A single
bath.

series: the sense of chill is followed by a beneficial feeling of warmth; the skin becomes soft and red, often to a great degree; the pulse exhibits greater fulness and becomes slower, often about 10 or 12 pulsations; the uncomfortable feeling in the sensorium gives place either to perfect clearness and cheerfulness, or it assumes the form of an agreeable sense of inebriation; the action of the muscles becomes freer, and even paralysed limbs occasionally regain more activity: at the same time the thermometer shows no increase of temperature below the tongue.

We find, accordingly, in the direct effect of the *thermal sool-bath*, a combination of the elementary effects of various forms of baths compressed within a short period of time: 1, the withdrawal of heat accompanying cold forms of baths, but immediately succeeded by reaction, during which the withdrawal of heat continues; 2, the sense of heat attending warm forms of baths, but without any actual increase of heat; 3, the stimulation of the nerve-centres during the whole continuance of the bath, without any shock, without any subsequent violent reaction, and without increase of the external heat; 4, the direct effect of warm and cold baths in a bath temperature, which during the continuance of the bath causes a constant withdrawal of heat, a withdrawal which is borne for a long time on account of the increased *feeling* of heat; 5, accordingly, therefore, the stimulating and quieting effect of cold and warm forms of baths at the same time. In a lesser degree these elementary effects appear in every tolerably strong *sool-bath*, with this difference, that for the latter a somewhat higher temperature is required, and the centripetal irritation of the nerve-centres is less plainly manifested. After each bath, the effects we have mentioned last for some time, though varying in different individuals; they exhibit themselves in a general sense of comfort, the appetite is immediately increased, the feeling of warmth continues to a moderate extent, without being accompanied by any unnatural increase in the production of heat; the promotion of the change of substance, according to Beneke's investigations, shows itself to a moderate extent in slight increase of the

urea and diminution of the phosphoric acid in the urine, and, above all, in greater daily variations in the products of the retrogressive metamorphosis.

The effect of the entire course of treatment which is produced by the collective amount of these separate effects, consists accordingly in a general improvement of nutrition and of the most important organic functions; and if, at the same time, a local ailment or some pathological product gradually disappear, this is due to the increased activity of the whole organism. Thus the thermal sool-bath, with regard to its general effect, represents an exciting form of bath, combined at the same time with a quieting influence, similar to that produced by the cold water system and the moderate thermal system; it causes a stimulation of the central organs, the immediate influence of which is accompanied by a withdrawal of heat. This combination of the effects of the cold water system, the thermal system, and the sool-baths, explains the fact why Rehme and Nauheim have risen into such successful competition with sool-baths, hydrotherapy, sea-baths, and indifferent thermæ, in all anæmic conditions, in rheumatic and scrofulous cases, in paralyses and other neuroses; but it also equally explains the fact why this competition is less connected with the names of diseases than with practical appreciation of individual conditions.

General effect.

The mode of treatment may, generally speaking, be characterised in the few following statements.

System of treatment.

1. The *amount of gas* must be abundant, and to a certain extent fixed in the water.

2. The *temperature* must not exceed certain limits of depth, and certainly not of height; the average degree is 30 to 32° Cent. (86·0° to 89·6° Fahr.); 34 to 35·5° Cent. (93·2° to 95·9° Fahr.) is a temperature at which the thermal sool-bath is often injuriously exciting.

3. The *manner of heating*, when this is required, must be so arranged as not to allow too much gas to escape into the air, and thus partly to lose its effect in the bath and partly to be inhaled with injurious consequences.

4. The method of treatment requires, generally speak-

ing, *calm unagitated baths*, so that the gas may not be ejected and inhaled, but that its absorption may go on undisturbed, and that the withdrawal of heat may not be unpleasantly increased by constant contact with fresh masses of water. The feeling of the bather plainly expresses this, inasmuch as the agreeable sense of warmth is diminished by every movement, or is changed into its reverse.

5. As the change of substance itself takes place in alternating phases of supply and consumption, of stimulation and repose, of increase and diminution, so the application of the means promoting it must be carried out in similar forms of suitable alternation; and, in their strength, time, and duration, must be adapted to the individual condition of the organism.

6. The *thermal sool-bath* is not followed, like very warm baths, by rest in the warm bed, but for the most part by *exercise in the open air*; none but invalids requiring very gentle management are allowed the warmth of bed.

7. The *duration* of each bath is regulated according to the time in which the withdrawal of heat begins to predominate and to suppress the beneficial effect of the stimulation. This time varies according to individual circumstances, and generally falls within the limits of 10 to 30 minutes.

8. In many cases *days of rest* must intervene, especially in the hot season.

9. *Cool* summers are to be preferred to hot summers, and this is the reason why many sick people bathe at Rehme and Nauheim in wet and cold seasons, who would have used Teplitz or sea-baths in the hot summer.

10. The specific character of a gaseous thermal sool-bath is a moderate withdrawal of heat, rendered imperceptible to the senses through the effect of the carbonic acid upon the sensitive nerves of the skin, and combined with the centripetal stimulation of the nerves by means of the carbonic acid.

EXAMINATION OF SUITABLE CLASSES OF CASES.

1. *Retarded Convalescence* is the case which most plainly, and with typical characteristics, exhibits the effect of the thermal sool-baths in their peculiar nature. As we showed at a former place (see p. 130 *et seq.*), in slight cases the object is obtained by general measures which facilitate the formation of new substance without too much increasing the consumption of that already existing: these general measures are diet, country and mountain air, simple warm baths, and the like. When, however, these remedies prove insufficient, thermal sool-baths may be recommended, as with a moderate and cooling temperature these add the easily bearable stimulation of carbonic acid to the effect of the water. The choice of sea-bathing only stands open in those cases in which there is no necessity to spare the power of the invalid, and to guard against loss of substance; in severe cases the choice wavers only between thermal sool-baths and prolonged *mountain air*, which in principle produces a similar effect; in the Alps, at a considerable elevation above the level of the sea, the integrant stimulants of life are diminished and the action of the vital functions is facilitated; in the thermal sool-bath the latter are slightly stimulated, without any great demands being made on the power of reaction and the activity of the organism itself, and this is combined with the quieting and strengthening effect of cooler baths, the lower temperature of which, being concealed by the momentary effect of the carbonic acid, is not perceived. Retarded convalescence of this kind is especially frequent after exanthematic fevers, typhoid fever, influenza, and climatic fevers, and particularly in cases where marked exhaustion of the spinal marrow has occurred in consequence of these diseases; and in these instances the baths containing carbonic acid are directly and almost exclusively indicated.

Retarded
convalescence.

Under this head we may place *conditions of weakness* proceeding from other causes, *imperfect development in childhood*, *general emaciation* after a toilsome life, *prema-*

Conditions
of weak-
ness.

ture old age, phthisical habits of constitution, habitual abortion from general weakness, and the like. Generally speaking, in these and similar conditions, where poverty of blood is not predominant, and which have not arisen from direct loss of juices of the body, the efficacy of iron is not to be relied on. *Rehme* and *Nauheim* hold a medium position between the strongly stimulating sea-bath and the other slightly exciting treatment of the indifferent thermal baths and simple sool-baths; the stimulating effect of the carbonic acid in general produces easily the required reaction without demanding any strong physical exercise, and in general the use of these baths, in contrast to sea-baths, corresponds rather with economising than with exerting the functions.

Anæmia.

2. *Anæmia*.—In discussing the courses of chalybeates in the next book, we shall meet with cases of anæmia and chlorosis which withstand the effect of iron and require moderately stimulating treatment, under the favourable effect of which, the deficient iron, like other necessary component parts of the blood, is assimilated from the food taken; these stimulating remedies are mountain air, sea-baths, sool-baths, indifferent thermæ and thermal sool-baths. We cannot lay down certain rules on the selection of the proper course; sometimes the trial must decide.

Plethora
of the
abdomen.

3. *Plethora of the Abdomen* (or abdominal venosity).—In another place we shall more fully show how in these morbid conditions internal courses of waters may be assisted by stimulating baths, and we shall especially point out the two practically important types of the thin and the corpulent hæmorrhoidal subject. In the former case, the thermal sool-baths, as stronger than simple sool-baths, affect the increase of nutrition and the formation of blood; in the latter case they prove effective by powerfully stimulating the circulation of the skin, and thus disburden the vessels of the abdomen. We have already, in the first book, mentioned the use of thermal sool-baths in cases of tabes proceeding from hæmorrhoidal congestion. From their use, and from the use of baths in general, bleeding of the rectum frequently occurs.

Gout.

4. *Gout* belongs to the cases adapted for *Rehme* and

Nauheim only in those instances in which general regulation of the change of substance, the relief of the abdomen by stimulating the circulation of the skin, and the production of beneficial bleeding of the rectum, are required. Considerable gouty swellings demand hot baths, or energetic internal courses of waters, or the cold water system. The case is similar—

5. In *Rheumatic Exudations of the joints of long standing*, in which thermal sool-baths are still often erroneously prescribed; none but fluid, recent and inconsiderable exudations yield to the baths of Rehme and Nauheim within the limited period of a course of bathing. On the other hand, *muscular rheumatism* is well adapted to these baths, which combine the effect of *carbonic acid* with that of sool-baths, especially when *weakness of skin* forms a prominent symptom; in these cases (see p. 110) the thermal sool-baths present a medium course between the cold water system and sea-bathing on the one side, and simple sool-baths on the other; from the latter they are distinguished by the fact that they stimulate the skin at a lower temperature, and therefore with a more cooling effect; from the former they differ by not so easily giving rise to colds. For cases, however, of so-called rheumatic paralysis, which is caused by atrophy of the muscles rheumatically affected, a strongly stimulating mode of bath treatment is required, and in most instances this has, moreover, to be assisted by Faradisation.

Rheumatism.

Muscular rheumatism. Weakness of skin.

6. *Scrofula*.—As we have already stated when speaking of simple sool-baths, and when discussing the Kreuznach mode of treatment (see pp. 199 and 218), the thermal sool-baths belong to those remedies which in the treatment of scrofula fulfil the object of generally improving the formation of blood and the nutrition; and, as regards the amount of effect produced by these, they hold a medium position between simple sool-baths and sea-baths. We shall not repeat the discussion, but only its result, namely, in cases in which the local exudations require to be speedily reduced, the sool-bath and sool-water treatment, promoting rapid absorption (Kreuznach), are indicated, with

Scrofula.

the internal use of iodine ; while Rehme and Nauheim are suitable in those cases in which the requirement of increased nutrition predominates.

Identical results in similar cases at both places have led to confusion ; they are either to be referred to medium forms of disease, or to be explained by variations in the methods of treatment ; for at Rehme and Nauheim, if necessary, the same courses may be carried out as at Kreuznach.

Treatment
in scrofula.

Generally speaking, the object of thermal sool-baths in scrofulous diseases, i.e., the stimulation of tissue-change and of nutrition, is obtained all the more rapidly and completely, the more the mode of treatment is satisfied with baths, in addition to the *régime* required. To begin the day's work with an early morning walk, and to drink salt water with its somewhat aperient effect, is, as a rule, a bad preparation for the thermal bath ; if the nutrition is to be increased, everything should be avoided which disturbs the appetite, and causes weakening secretions which depress the heat of the body (p. 90). Every moment in which the organs of assimilation are disposed to the reception of nutriment ought to be used for this purpose, and a glass of seltzer water is often a far better preparation for breakfast than the fatigue of a promenade to the waters and the drinking of them. And for the same reason we prefer a few doses of iodide of potassium and iodide of iron, given in the afternoon and evening, to a course of any of the favourite iodine springs ; the breakfast of the invalid is in these cases often more important, and appears to us more efficacious than the introduction early in the morning of so much salt water as is required for a small dose of iodide of sodium and iodide of magnesium.

Diseases of
the bones.

7. *Diseases of the Bones*, inflammation of the joints, caries, and necrosis, partly belong to the list of scrofulous cases, and partly proceed from other general conditions or from local influences. The state of these invalids, as regards etiology, essential origin, and treatment, resembles for the most part that of retarded convalescence ; and thus we may explain in such cases, the efficacy of Rehme and Nauheim. The object of the treatment is to preserve the strength of the invalid for the long progress of the local disease and for the

loss of juices connected with it, and, if possible, to improve the nutrition of the diseased part by generally increasing the tissue-change. The cases mentioned, especially also the consequences of gun-shot fractures, are to be met with in very many baths—in *France*, at the sulphur-bath of *Barèges* and at the salt-bath of *Bourbonne*; in *England*, at *Bath*; in *Germany*, at *Rehme*, *Wiesbaden*, *Teplitz*, *Gastein*, and others. Every remedy that promotes change of substance is adapted to these cases, and the choice is only regulated by the individual conditions of each case. For the general object, cooler baths are to be preferred, especially in those cases in which the local disease is accompanied by a continued fever, because cool baths diminish the pulse, and have a direct antipyretic effect.

Thermal sool-baths, possessing the stimulating influence of carbonic acid, allow a cooler temperature of baths, even when of prolonged duration, and they thus frequently mitigate or remove fever.

8. *Diseases of the Brain*.—We have already spoken (p. 153) of hemiplectic paralysis, and of paralysis of the will and mind (p. 149). Diseases of the brain.

9. *Tabes Dorsalis*.¹—*Rehme* is frequented by a great number of paralysed invalids, and especially by those suffering from *tabes*, amounting annually to some hundreds; and it owes its rapid rise from the first to several cases which bore the appearance of *tabes*, and which were essentially improved, and even apparently cured. Tabes dorsalis.

We have already mentioned (p. 156) the difference which exists in the views on this subject between the physicians at *Rehme* and those at *Nauheim* (especially *Beneke*). We have also stated that in decided and long-established cases of *tabes*, we have only aimed at checking the malady and in producing some improvement, while in some very recent cases we have effected recovery; these, however, have presented rather the appearance of weakness of the spinal marrow combined with slight ataxic symptoms; and in these cases, we would again draw

¹ See the etiology of diseases of the spinal marrow in the pamphlet already quoted—*Rehme und die Grundzüge der allgemeinen Balneologie*. Berlin, 1865.

attention to the important alternative between Gastein and Rehme (p. 159).

While at Nauheim the internal use of the sool-waters is often resorted to besides bathing, the system pursued at Rehme excludes almost entirely all drinking of waters in cases of tabes, spinal irritation, and other forms of neurosis. The invalids are prescribed a quiet unagitated life; the early morning hours, which, in cases of neurosis, are almost always the worst time, are spent in repose; the general innervation is regulated by satisfying the appetite; and not till two hours after breakfast is the bath taken, and this bath is the only daily remedy prescribed. In tabes and similar conditions we consider a course of waters and a walk to the springs an error both of diet and of regimen, and we exempt our sick from measures which overtire their small strength in the early morning.

Meningitic
para-
plegia.

10. *Paralysis in consequence of acute Spinal Meningitis* is one of the conditions in which Rehme, when the case is not of long standing, almost always effects an improvement, which often resembles a complete recovery, and the cure of which has established the reputation of this bathing resort (see p. 159). In this disease, also, we are generally satisfied with the use of baths, the duration of which we gradually extend, while we avoid courses of drinking waters unless urgently required; the more so, as the invalid is unable to take exercise. It is a matter of course that also in these cases the Nauheim baths, used in the same way, must produce the same effect as Rehme; though the great attention paid to exudative meningitis at the latter place has directed special attention to the disease.¹

After the termination of the acute stage, which is marked by fever and violent eccentric pains, paraplegia develops itself, *without paralysis of the sphincters and without anaesthesia*; and this is the point at which the antiphlogistic treatment hitherto indicated must give place to that of baths which produce the absorption of the

¹ See Braun, *Bemerkungen über die besonders nach Feldzügen beobachtete Meningitis spinalis der Officiere*. *Deutsche militärztl. Zeitschrift*, vol. i. p. 116. 1872.

meningitic exudation, by combining the thermal effect with the centripetal stimulation of the carbonic acid; and the most successful cases are those in which this course of treatment can be begun from the sick bed, immediately after the termination of the acute stage; the longer, however, the exudation remains, the slower and the more incomplete is its absorption, and the tardier is the recovery of the spinal marrow from the effects of its pressure. As a typical specimen of the most favourable result, we have described an instructive case in our pamphlet upon Rehme.

11. In *spinal irritation, hysterical paralysis, spinal paralysis of children*, as well as in cases of the specific *typhoid paralysis* of the extensors of the foot, and in *local disturbances of nutrition* after fractures, traumatic inflammation of the joints, œdema, and the like, the indications for the use of thermal sool-baths fall under the various aspects of thermal treatment generally, and have been mentioned in their respective places. Their elementary effect proceeds from a moderate amount of central stimulation combined with cool bath-treatment, and their general effect rests on the improvement of sanguification and nutrition. Neuroses.

12. *Sexual Diseases of Women.*—Neither our own experience nor Beneke's discreet expressions regarding Nauheim allow us to attribute special powers to the thermal sool-baths. The absorption of fibroids of the uterus and of ovarian tumours is as little promoted by these baths as by other remedies; chronic metritis and uterine catarrh are frequently improved by simple sool-baths or by moderate courses of waters; irregular or painful menstruation, especially when combined with periodic and symptomatic hyperæmia of the ovaries, is benefited by sool-baths or thermal sool-baths, and the consequent anæmia and atrophy are often relieved. This is, however, all that can be said; and possible indications for the use of Rehme and Nauheim baths are not to be deduced from local conditions, but from the general state of the health, and in this respect they fall under the treatment of anæmia and retarded convalescence. This retarded convalescence is Female sexual diseases.

frequently not merely the consequence of the disease, but also of the special gynæcological treatment; and as Beneke concludes the section of his pamphlet upon Nauheim, referring to the subject, with the advice which he gives to a convalescent invalid, not again to visit an establishment for the cure of female diseases within the course of the following winter, so at Rehme we have restored the general health of many a patient who had been exhausted by leeches, caustic remedies, and uterine sounds.

Chronic
eczema.

13. *Chronic Eczema*.—The remarks made on pp. 111 and 196 with regard to the treatment of chronic exanthemata, refer also to the thermal sool-baths of Rehme. Leaving scrofulous and pustular forms of eruption out of the question, we have seen but rare and slight results from the use of sool-baths and thermal sool-baths in cases of psoriasis, but no improvement at all in those of eczema—in fact, rather the reverse; and we can confirm Hebra's warning against the use of salt baths.

Rehme.

Rehme (Oeynhausen), 134 feet above the level of the sea, is situated in a broad and fertile valley, watered by the Weser and the Werre. The climate is fresh and mild, and is under the influence of the German Ocean. Spring and autumn are longer, and violent changes of temperature are more rare than in other continental climates. Hundreds of small mountain-streams flow through the valley. Currents of wind are not unusual, and they temper the heat of the warm summer days; generally speaking, cooler weather is more conducive to the effect of thermal baths than great heat. The station of the Cologne and Minden railway lies in the centre of the newly risen town of Oeynhausen, which was founded with the establishment of the baths in 1845, and was named after its founder; yet the older and more convenient name of Rehme has remained most in use.

Remedial Resources.—1. The *thermal sool-baths* (for analysis see above, p. 235), supplied from two borings of 2,200 and 1,800 feet in depth.

2. The *simple sool-bath*, supplied by the graduated sool of the salt-works, and, when desired, strengthened with mother-lye.

3. The *sool-spray-bath*, a dome-shaped building, in which the thermal sool is pulverised by thousands of cascades. It forms an inhalation apartment, supplied with a warm atmosphere of 24° to 30° Cent. (65·2° to 86° Fahr.), saturated with vapour impregnated with suspended particles of salt, and containing carbonic acid (2 to 4 per cent.). The inhalations are especially used in cases of chronic bronchial catarrh, ozaena, catarrh of the throat and Eustachian tube, and formerly also in asthma, in which latter malady we have scarcely any successful results to record. The great amount of carbonic acid in the air produces, remarkably enough, little or no effect in the vapour-bath, and only under special circumstances does it cause any symptoms of poisoning, whilst the tenth part of this amount is often unbearable in rooms closely crowded with human beings (see p. 35). Similar arrangements are to be found also in other sool-bath resorts—Kreuznach, Reichenhall, Elmen, and others. Any supposed effect of this remedy in cases of tubercle on the lungs is erroneous.

4. A *wave bath* in the Werre, beneath the high wheels of a mill, producing strong undulations.

5. *Gas-baths*, of carbonic acid gas, of very doubtful effect, the use of which, for the most part, rests on the curiosity of the public and on the belief existing in the efficacy of especially remarkable contrivances. The author has only seen successful results attending their use in cases of atonic *ulcers*; also, occasionally from the use of the gas-douche upon the atonic uterus in cases of irregular menstruation; but he must declare the application of gas-douches in cases of eye and ear diseases to be mere trifling.

6. The *Bülów spring* and the *Bitter spring*; the latter being a mild bitter water, containing common salt; the former is a weak sool, containing 2½ per cent. of Glauber's salt, and it is drunk diluted with carbonic acid water.

7. *An establishment for mineral waters* furnished with all natural and artificial waters.

8. An establishment for goats' whey, managed by a Swiss. (Drs. Braun, Driesen, Lehmann, Rinteln.)

Nauheim, 450 feet above the sea, station on the Main

ture old age, phthisical habits of constitution, habitual abortion from general weakness, and the like. Generally speaking, in these and similar conditions, where poverty of blood is not predominant, and which have not arisen from direct loss of juices of the body, the efficacy of iron is not to be relied on. *Rehme* and *Nauheim* hold a medium position between the strongly stimulating sea-bath and the other slightly exciting treatment of the indifferent thermal baths and simple sool-baths; the stimulating effect of the carbonic acid in general produces easily the required reaction without demanding any strong physical exercise, and in general the use of these baths, in contrast to sea-baths, corresponds rather with economising than with exerting the functions.

Anæmia.

2. *Anæmia*.—In discussing the courses of chalybeates in the next book, we shall meet with cases of anæmia and chlorosis which withstand the effect of iron and require moderately stimulating treatment, under the favourable effect of which, the deficient iron, like other necessary component parts of the blood, is assimilated from the food taken; these stimulating remedies are mountain air, sea-baths, sool-baths, indifferent thermæ and thermal sool-baths. We cannot lay down certain rules on the selection of the proper course; sometimes the trial must decide.

Plethora
of the
abdomen.

3. *Plethora of the Abdomen* (or abdominal venosity).—In another place we shall more fully show how in these morbid conditions internal courses of waters may be assisted by stimulating baths, and we shall especially point out the two practically important types of the thin and the corpulent hæmorrhoidal subject. In the former case, the thermal sool-baths, as stronger than simple sool-baths, affect the increase of nutrition and the formation of blood; in the latter case they prove effective by powerfully stimulating the circulation of the skin, and thus disburden the vessels of the abdomen. We have already, in the first book, mentioned the use of thermal sool-baths in cases of tabes proceeding from hæmorrhoidal congestion. From their use, and from the use of baths in general, bleeding of the rectum frequently occurs.

Gout.

4. *Gout* belongs to the cases adapted for *Rehme* and

Nauheim only in those instances in which general regulation of the change of substance, the relief of the abdomen by stimulating the circulation of the skin, and the production of beneficial bleeding of the rectum, are required. Considerable gouty swellings demand hot baths, or energetic internal courses of waters, or the cold water system. The case is similar—

5. In *Rheumatic Exudations of the joints of long standing*, in which thermal sool-baths are still often erroneously prescribed; none but fluid, recent and inconsiderable exudations yield to the baths of Rehme and Nauheim within the limited period of a course of bathing. On the other hand, *muscular rheumatism* is well adapted to these baths, which combine the effect of *carbonic acid* with that of sool-baths, especially when *weakness of skin* forms a prominent symptom; in these cases (see p. 110) the thermal sool-baths present a medium course between the cold water system and sea-bathing on the one side, and simple sool-baths on the other; from the latter they are distinguished by the fact that they stimulate the skin at a lower temperature, and therefore with a more cooling effect; from the former they differ by not so easily giving rise to colds. For cases, however, of so-called rheumatic paralysis, which is caused by atrophy of the muscles rheumatically affected, a strongly stimulating mode of bath treatment is required, and in most instances this has, moreover, to be assisted by Faradisation.

Rheu-
matism.

Muscular
rheu-
matism.
Weakness
of skin.

6. *Scrofula*.—As we have already stated when speaking of simple sool-baths, and when discussing the Kreuznach mode of treatment (see pp. 199 and 218), the thermal sool-baths belong to those remedies which in the treatment of scrofula fulfil the object of generally improving the formation of blood and the nutrition; and, as regards the amount of effect produced by these, they hold a medium position between simple sool-baths and sea-baths. We shall not repeat the discussion, but only its result, namely, in cases in which the local exudations require to be speedily reduced, the sool-bath and sool-water treatment, promoting rapid absorption (Kreuznach), are indicated, with

Scrofula.

CHAPTER III.

SEA-AIR AND SEA-BATHS.

Funda-
mental
character
of effect.

THE effect of sea-baths is not to be separated from the influence of sea-air; both influences combined represent the ideal of a course of baths strongly promoting change of substance, and the choice between it and other milder methods of treatment is based solely and entirely on the individual capacity of the organism in question. As regards names of diseases, most of the diseases adapted for the cold water and thermal systems are also suitable for sea-baths; the selection of *individual cases* of these diseases depends, however, on a certain amount of vigour in the organic functions, and in this respect the sea-bath holds a medium position between the cold water and thermal systems, and may be considered as a climatic treatment *combined with a stimulating form of the cold water system.*

Sea-air.

As, however, the physiological and therapeutic effect of a stay at the seaside upon the change of substance and the functions of nutrition, appears even after a few days as the result of the sea-air alone, and the corresponding effect of the sea-baths is obtained also from the other stimulating forms of the cold system, in estimating seaside treatment the climatic side of it holds the more prominent position, and *sea-air appears the specific influence in the treatment prescribed.* From the results furnished by the physical and chemical investigation of sea-air, it contains properties which characterise it plainly enough physically; still, it is not to be denied that between these and the therapeutic effect, the link of a physiological connection is still very defective. There is, indeed, no lack of physiological theories as to the effect

of the various influences of sea-air, but they are by no means accurately and experimentally established. Fortunately, however, experience as to the final result of sea-air is so universally and surely fixed, that it is not shaken by the want of an established theory. The general pharmacodynamic character is the *powerful stimulation of the change of substance, both retrogressive and formative, expressed in the striking increase of urea and decrease of uric acid and phosphoric acid in the urine, in the greatly increased requirement of food, and in the rapid and considerable increase of the weight of the body.* These characteristics belong, as we have seen, to the general effect of sool-baths and thermal sool-baths, but in a far higher extent to sea-air; and the investigations by Beneke on the subject have been universally confirmed by subsequent inquirers, and equally so the fact that the effect upon the change of substance, the nutrition and the weight of the body, is very rapid in its appearance.

The properties of sea-air, the combination of which produce this effect, but the detailed explanation of which is still subject to great doubts, are the following.

1. The *temperature of the sea-air* in the summer months, owing to the constant evaporation going on from the surface of the sea, is far *lower* than in inland districts; it is, however, also far more *equable*, partly because this evaporation is comparatively uniform and deviates but little from the point of saturation in the air, and partly because the immense mass of sea-water is not affected by any sudden coolness, but, on the contrary, the same temperature is often maintained for weeks, though that of the atmosphere has considerably diminished. This moderate and even temperature may partly explain the fact why persons resident by the seaside are less subject to colds; though this, of course, may be also attributed to the better nutrition of the body and to the direct effect of the sea-baths upon the skin.

Tempera-
of sea-air,
and its
moisture.

2. The contrary is the case with the *variations of the barometer*. Whilst the temperature is more equable than in inland and mountain districts, the variations in the

Variations
of the ba-
rometer.

pressure of the air on the sea-shore are greater and more frequent. What influence upon the different functions of the body is to be ascribed to this fact, remains an open question; and we can only repeat the general opinion mentioned in the first book when speaking of atmospheric pressure, namely, 'if we reflect that, according to G. Lehmann's observations, all rapid variation in the atmospheric pressure increases the number of pulsations and quickens the respiration, and that organic life depends on these alternate phases of repose and excitement and indeed of varying excitement, we may on the whole assume that a rapid change in the state of the barometer is more favourable to the more important functions of life than its relative stability.' Moreover, though the amount of the barometrical variations is greater, they are far more regular than they are inland, and it is plain that this regularity must more rapidly promote the accommodation of the organism to the new medium.

Density of
the air.

3. The *absolute density* of the air is the influence to which at all times the greatest part of the effect of sea-air has been ascribed. Referring to the first book (p. 47, *et seq.*) we will here only recapitulate the general result of investigations: namely, in the first place, the increased frequency of the pulse with diminished atmospheric pressure and its diminished frequency with increased pressure is a fact universally asserted, and to some degree confirmed by various observations, especially in the use of the compressed-air apparatus, but it is in nowise sufficiently authenticated in its more exact details; in the second place, the statements with regard to increased and diminished expiration of carbonic acid under different atmospheric pressure are not supported by any convincing investigations; in the third place, the absolute increase of the reception of oxygen, and the greater oxidation of the juices and tissues thus produced, seems to have the greatest and most important share in stimulating the change of substance.

Purity of
sea-air.

4. The *purity* of sea-air is, of course, greater than that of inland air; and, with regard to organic products of decomposition, sea-air may perhaps be regarded as abso-

lutely pure, on account of the constant and *regularly alternating currents of air*. In other respects, the chemical combination of the sea-atmosphere presents no important and constant differences compared with that of inland air. The increase of oxygen only exists in proportion to the greater weight of the volume, and not with regard to the amount of nitrogen. The carbonic acid in sea-air is from 1 to 2 ten-thousandths less than in inland air, and this difference may be considered as wholly unimportant; the amount of ozone seems to be increased. Iodine and bromine often assert their existence in sea-air by smell, but their amount is too small to be quantitatively measured; on the other hand, the presence of suspended chloride of sodium is indisputable, and its mildly exciting effect on the respiratory membrane is not improbable.

[These remarks, we ought to bear in mind, relate principally to the qualities of the sea-air, under the influence of sea-winds; for when the wind comes from the land, the air is by no means free from organic admixture. We need only refer to the sufferings of invalids subject to hay-asthma in proof of this.]

It is to be hoped that by comparative investigations the importance of these different influences of sea-air may be more accurately ascertained; the effect of them, when combined, consists, as we have said, in a powerful stimulation of the retrogressive and formative change of substance, but it presupposes also such an amount of soundness in the assimilating functions as corresponds with the acceleration of the retrogressive metamorphosis. When this corresponding amount does not exist, the good effect of sea-air fails to appear, and the sick person, whose retrogressive change of substance is powerfully stimulated, without the organs being equal to the demand thus proportionally increased for the assimilation of new material, is overpowered. This is the principle upon which the indication and contra-indication of sea-air rests as regards individual cases, not on the name of anæmia, rheumatism, gout, &c.

General
indication.

[We may here suggest that there is also a class of people with whom sea-air does not agree, on account of

a defect in the eliminating, not in the assimilating power.]

Sea-bathing.

The *sea-bath*, as such, belongs to the category of cool and agitated forms of baths, and, indeed, to the class of those exciting baths which, after the short primary effect of the cold on the tissues of the skin and on the central organs, promote a prompt reaction. Although the medium temperature of the sea-water in the summer months in which baths are taken, is considerably higher than that of most of the ordinary cold water baths, namely, 19° to 22° Cent. (66.2° to 71.6° Fahr.) in the northern sea-bathing resorts, and 25° to 27° Cent. (77.0° to 80.6° Fahr.) in southern ones, still it is always a cool bath, and the withdrawal of heat is also considerably increased by the constant motion of the water. It is the latter cause especially which increases and accelerates stimulation and promotes reaction; the lesser degree of cold of the water, however, and the greater warmth of the air facilitate this reaction; and thus the generally adopted short duration of each sea-bath is to be explained upon the common principle applicable to all cool and stimulating forms of baths, namely, that the bath is to end as soon as the reaction has begun and before the depressing effect can take place. Each sea-bath is therefore to be reckoned by minutes and even by seconds, and with delicate persons is rarely prolonged beyond five minutes.

Amount of salt in sea-water.

Besides being a cool and stimulating form of bath, the *sea-bath* has also the effect of an *actual sool-bath*. The amount of salts is limited (apart from insignificant component parts, such as bromine, iodine, and carbonate of lime) to chloride of sodium, chloride of magnesium, sulphate of magnesia, sulphate of lime, and sulphate of potash, which appear in the following proportions in different seas (number of grains to 16 ounces).

	Chloride of Sodium.	Chloride of Mag- nesium.	Sulph. of Mag- nesia.	Sulph. of Lime.	Sulph. of Potash.
Atlantic Ocean .	190-203	20-28	4-7	9-15	11-12
North Sea . .	179-195	21-41	5-35	4-12	3-11
Mediterranean .	170-260	24-47	5-54	4-30	4-13
Baltic Sea . .	39-95	11-22	3-6	4-5	2-4

As in estimating the effect of sool-baths on the skin only the chlorine combinations are taken into consideration, we find in the *Baltic Sea* a sool of $\frac{1}{2}$ to $\frac{1}{4}$ per cent. of chlorine combinations, in the *North Sea* $2\frac{1}{3}$ to $2\frac{2}{3}$ per cent., in the *Mediterranean* $2\frac{1}{4}$ to $3\frac{1}{2}$ per cent., and in the *Atlantic Ocean* $2\frac{1}{3}$ to $2\frac{3}{4}$ per cent. The Baltic Sea, therefore, furnishes very weak sool-baths, and the other seas mentioned moderately strong and strong sool-baths.

As regards the mechanical contact of the chlorine combinations with the skin, and the irritation thus probably produced, the same condition must exist with sea-waters as with sool-baths; the strong desquamation of the used-up epidermis, and the falling off of saline crusts after the sool-bath give evidence of this mechanically chemical effect, no less than the fact that the warmth of the skin and its redness after a cold sea-bath are more rapidly restored than after an equally cold river-bath. The short duration of the sea-bath may, of course, weaken this part of the effect.

The time for sea-bathing is regulated according to the climate of the place in question. The main requirement is that the temperature of the air should be of a moderate summer-heat, and that it should have had a sufficiently long influence upon the sea to warm its water to a fixed temperature of 19° to 22° Cent. ($66\cdot2^{\circ}$ to $71\cdot6^{\circ}$ Fahr.), or at any rate to from 15° to 19° Cent. (59° to $66\cdot2^{\circ}$ Fahr.), or from 19° to 25° Cent. ($66\cdot2^{\circ}$ to $77\cdot0^{\circ}$ Fahr.). The more northerly the position of the bathing resort, the shorter therefore is the suitable season for bathing, and the more is it limited to the hottest weeks of summer and autumn; the more easterly and continental the situation, the greater the contrast between the cool temperature of the water and the heat of the air during the day, and the greater are the variations of the atmospheric temperature generally; the more southerly and westerly the situation (we refer to Europe only) the longer is the time suitable, extending even till late in the autumn; and in very southerly situations the hottest months are even avoided, because the great heat of the air and the power of the sun's rays are to be feared. A

Period for
sea-bath-
ing.

medium place in this respect is occupied by the shores of the German Ocean, the period for which is the months of July, August, and September; and altogether the watering-places on the German Ocean (and the south and west coast of England) seem especially adapted for sea-bathing with regard to the temperature both of air and water, and this explains the preference usually given to them. [These advantages are shared by the North Coast of France, the Channel Islands, the coasts of Ireland and the West of Scotland with the Isles.]

Warm sea-water
baths.

Arrangements for warm sea-water baths have been for some time usual at many of the sea-shore watering-places. If these are to fulfil the object aimed at, they ought to be arranged with care, owing to the constant currents of air, and the sick should be protected from cold after the warm bath. They afford a powerful remedy by combining ordinary sool-baths with the enjoyment of sea-air, and the effect of sool-baths upon the change of substance is by this means directly increased.

Ill results.

The failure of a course of sea-bathing, which had promised certain success, is not unusual, especially in cold and stormy summers; for a course of sea-baths, more than any others, is dependent on the favourable condition of the weather. Equally frequently, failures occur through faults of diet, when the sick person gives way to his stimulated appetite more than his digestion can bear; and in a course of sea-baths, more than in many other modes of treatment, it is especially necessary to watch the condition of the sick person's functions during the course of the remedy, and to discontinue the latter at once if no improvement of nutrition become apparent.

EXAMINATION OF CLASSES OF CASES.

Conditions
of weak-
ness.

1. *Conditions of Weakness.*—As in promoting the change of substance, so in conditions of general weakness of uncomplicated character, a course of sea-baths is the ideal of all modes of treatment, and stands at the head of all tonic remedies. It is indispensable, however, that the sluggishness in sanguification and nutrition neither pro-

ceeds from nor is accompanied by any considerable organic changes in the organs of assimilation and circulation, but arises either from deficient *nutrition* in the organs of assimilation themselves or from their insufficient *innervation*. General atrophy in consequence of physical inactivity combined with mental overwork, but without any real organic disease, is the most distinct and certain indication in favour of sea-bathing: catarrh of the stomach, ulcer in the stomach, inflammation of the liver and cirrhosis, and insufficiency of the heart and lungs are the strongest *contra-indications* against sea-bathing; and between the two extremes, the decision must be made with regard to each individual case according to the prevailing relation to one or the other condition. Considerable anæmia in consequence of direct loss of blood and transudations, chlorosis with mitral or aortic regurgitation, bronchial catarrh combined with great bronchial dilatation, and organic diseases of the heart, forbid the violent stimulation of sea-bathing; but anæmia indirectly produced, especially by neurosis and sorrow, and the not unfrequent cases of chlorosis which occur though the organs of circulation are sound, and which nevertheless obstinately resist repeated courses of iron, indicate and allow directly exciting remedies, among which the various forms of chemical and sool-baths may be regarded as milder treatment, sea-bathing as the most powerful, and the thermal sool-baths of Rehme and Nauheim as the medium.

As regards *Phthisis*, the advanced cases may be reckoned among the contra-indications above mentioned; while less advanced apyretic forms, without vascular excitability, are often benefited by sea-air, as a means of increasing the nutrition and the weight of body; yet careful attention to the case is in these instances urgently required, as the influence of such a strongly stimulating remedy on the vascular system cannot be calculated beforehand.

2. *Scrofula*.—The alternative already mentioned in scrofulous cases (p. 219) with regard to Kreuznach and Rehme, may be enforced still more strongly with respect to sea-bathing. Where important organic changes,

especially in the lymphatic glands, exist, strongly stimulating means like the sea-bath are often less suited than remedies calculated to promote absorption. With regard to the choice between Rehme and Nauheim and sea-baths, the decision must be regulated by the capability of the organism for reaction and the state of the skin; where these require delicate management, the preference must be given to the thermal sool-baths, in other cases to sea-air and sea-baths.

Weakness
of skin.

3. *Weakness of Skin* has been already fully mentioned in other places. Cool modes of treatment are indicated, and among others sea-bathing, under two conditions: 1. When the weakness of skin is a symptom of general weakness of nutrition; 2. When it is not so great as that, on each application of a cold bath, a cold is produced, and thus fresh congestion of the internal organs, especially of the intestinal membrane, is caused.¹

Neuroses.

4. There are only a few *Paralytic Conditions* suited for sea-bathing. Like every other cold mode of treatment, it is a more than doubtful remedy in cases of meningitic exudation and apoplectic transudations and cicatrices. Many cases, however, of *Tabes*, and especially of *Spinal Irritation*, find at the sea-side, and in the enjoyment of sea-air, a reviving and strengthening remedy, particularly after a preceding course of thermal treatment. Sea-bathing and sea-air have generally a beneficial effect in many cases of so-called *nervous weakness*, i.e. of irritable weakness of the central organs, comprehended under the various denominations of hypochondriasis, hysteria, and spinal irritation; and in the same category we may also reckon *Hemicrania*, a malady which resists almost all remedies, but which is more frequently cured or alleviated by sea-air and sea-bathing than by other means.

Rheuma-
tism.

5. Of all *Rheumatic Conditions*, none but muscular rheumatism is suited for sea-bathing, and the effect in this case almost exclusively relates to the weakness of skin. Among the most favourite cases for sea-bathing those of so-called *nervous rheumatism* are mentioned, a term which possesses no scientific value, but which is applied to the

¹ See pp. 73, 110, 116, 139, 195.

most different cases of nervous weakness, hysteria, and spinal irritation.

6. In addition to these most usual and general indications for sea-bathing, there occur in practice many individual cases, which are to be judged by general rules. Above all, sea-bathing is one of the most important *restorative remedies* for those conditions which cannot be designated by the name of any malady, but only as *states of weakness*; and in the grand aspect of the majestic ocean and in the thousandfold life of its vegetable and animal inhabitants, both heart and soul find that condition of mind which on page 24 we have designated as *collectedness*.

SEA-BATHING PLACES OF ENGLAND.

[England is remarkably well provided with sea-side places, with excellent air and good opportunity for bathing; but the great importance of the sea-air and of sea-bathing as *remedial agents*, for good as well as evil, is scarcely sufficiently appreciated. The majority of the immense numbers of visitors at sea-side places act without medical advice. When a family wants a 'change' the heads select an inland or sea-side place or a continental tour, according to general convenience; and, while at the sea-side, they bathe or make their children bathe, because it is the custom or because some friends have derived benefit from it, and more or less serious illnesses are occasionally the consequence, and generally not till then the local or the family doctor is consulted. Although at most places warm sea-water baths may be had, really good arrangements exist only at a few fashionable places, as Brighton, Folkestone, and Scarborough. And the warm sea-baths are likewise generally taken more on the prompting of the inclination than on the advice of medical men. Regular courses of warm sea-water baths under the superintendence of a physician are quite exceptional, although infinite advantages might be derived from them, either alone or combined with the internal use of waters. Many invalids would gain more from such a plan properly carried out, than from a visit to a continental spa. We have ourselves

had the opportunity of experiencing this in several cases at Folkestone, where the patients had the advantage of Dr. Bowles's guidance.

Although an account of the sea-side watering-places of Great Britain, with their climatic peculiarities, facilities for courses of bathing, and similar information, would be useful as a guide to the practitioner, it does not lie in the scope of this handbook, and we must confine ourselves to a short notice. On the eastern coast, with a dryer and somewhat more bracing climate, we may mention *Tynemouth*, at the mouth of the Tyne, with good arrangements also for warm sea-baths; *Redcar*, in Yorkshire, a small place, but possessing beautiful sands; *Saltsburn-by-the-Sea*, a few miles from Redcar; *Whitby*, with an excellent climate on the west-cliff, and an interesting neighbourhood; *Scarborough*, the most fashionable of the northern watering-places, built on the cliffs round a magnificent bay, having been much visited in former times, before sea-bathing came into fashion, on account of two aperient chalybeate springs; *Filey* and *Bridlington*, likewise in Yorkshire. Further south we have *Cromer*, *Yarmouth*, *Lowestoft*, *Aldbrough*, *Dovercourt*, *Southend*, *Margate*, with its well-known marine hospital, *Broadstairs*, *Ramsgate*, *Deal*, and *Dover*.

On the south-eastern coast, which by its climate may be regarded as intermediate between the eastern and the southern, *Folkestone* occupies a prominent place by its double climate, viz., the more sheltered sea-shore, with the excellent bathing establishment, and the open west-cliff, with a less pronounced sea-climate; *Sandgate*, *Hastings* and *St. Leonards*, with a less invigorating summer climate; *Eastbourne*, by its open situation again somewhat more bracing; *Brighton*, though much frequented for sea-bathing, still more important for its bracing sea-air, from September till January. Further west follow *Worthing*, *Littlehampton*, *Bognor*, the *Isle of Wight*, with *Shanklin*, *Sandown*, *Ryde*, *Cowes*, *Freshwater*, and other places. Opposite the Isle of Wight we have *Bournemouth*, more as a winter residence; further west are *Swanage*, *Weymouth*, *Budleigh Salterton*, a delightful little place, of recent origin; *Dawlish*, and *Torquay*, more for their winter

climates; *Teignmouth*, the largest sea-bathing place in Devon. In the remote south-west, *Penzance* and some smaller places in Cornwall are distinguished by a moist climate, but much more even as to annual and diurnal range. *Lynmouth* and *Ilfracombe*, in North Devon, with an aspect on the Bristol Channel, are again rather less moist and somewhat fresher, with very fine country in their immediate neighbourhood; *Weston-super-Mare*, *Portishead*, and *Clevedon* on the Bristol Channel, in *Somersetshire*. On the west coast of Wales, *Tenby* and *Aberystwith* are first-class sea-bathing places. On the north coast *Penmaen Mawr*, *Llandudno*, with several smaller ones besides, as *Rhyl*, *Abergele*, *Aber*, *Beaumaris*, &c. The coast of Lancashire, Westmoreland and Cumberland has, amongst other places, *Fleetwood*, *St. Bees* and *Silloth*, with good accommodation and most interesting scenery, and the Isle of Man possesses likewise advantages.

Scotland offers even better places for sea-bathing and sea-air than England, but most of them have only limited accommodation. North Berwick and the neighbourhood of Edinburgh and St. Andrews, and the coast of Banffshire, are for some constitutions preferable to many more southern places; the most rising, however, is probably *Nairn*. Among the numerous places on the west coast, we will mention only *Rothesay*, in Bute, and *Ardrossan* near the firth of Clyde, both offering good accommodation; the former having at the same time a sulphur-spring, the latter a chalybeate.

Ireland is, in this respect, not less fortunate than either England or Scotland. Not far from Dublin is *Bray*, the 'Brighton of Dublin;' further north we have *Duncannon*, *Tramore*, *Rostrevor*, a favourite spot, and *Portrush*, in magnificent scenery, close to the Giant's Causeway. More to the south the vicinity of *Cork* offers several localities, and on the south-west *Kilkee* is a favourite resort; in the north-west, on the Donegal Bay, *Bundoran* is most liked; and there are, besides, several other good localities sharing with them the advantages and disadvantages of the direct influence of the Atlantic Ocean.]

SEA-BATHING PLACES NEAR THE GERMAN, BELGIAN, DUTCH,
AND FRENCH COASTS OF THE GERMAN OCEAN AND THE
CHANNEL.

North Sea
watering-
places.

Heligoland, the well-known little Friesland island in the possession of England, six miles from the mouth of the Weser and the Elbe, and connected with Hamburg and Bremen by regular steam-vessels, consists of a sandstone rock; the high country, reached by an ascent of 190 steps; and a small foreland, the low country. With regard to sea-air, Heligoland has an advantage beyond that of many other watering-places, owing to its situation far out in the sea, for which reason, whatever the quarter of the wind, the sea-air is never quite supplanted by inland air. (Drs. von Aschen and Zimmermann.)

Ostend, on the Belgian coast, is the most frequented watering-place on the Continent. (Drs. Janssens, Noppe, and Soenens.)

Blankenberghe, also on the Belgian coast, three hours from the railway station of Bruges, a fishing village of 3,000 inhabitants, has the advantage over Ostend in the greater spaciousness of its seashore promenade and a more quiet life. (Drs. Letten and Verhaeger.)

Scheveningen, on the Dutch coast, one hour from the Hague, and connected with that city by railway, possesses a beautiful woody promenade. It is a much frequented and fashionable watering-place, and one of the most agreeable, though rather more expensive than many others. (Dr. Mess.)

Norderney, an East Friesland island, belonging to the Prussian province of Hanover, containing 1,000 inhabitants, is connected with Bremen by steamers, and with Emden by steamers and waggon post (at the ebb tide). (Drs. Fromm, Gazert, and Kirchner.)

Other places [though of little importance for England], are: *Westerland auf Sylt*, *Wyk auf Föhr*, *Cuxhaven*, *Dangast*, *Wangeroog*, *Spierkerroog*, and *Borkum*.

[On the Northern coast of France there are several much frequented watering-places which possess the advantage, to

invalids most valuable, of cheerful, almost gay, social arrangements : Calais, Boulogne, Dieppe, Etretat, Fécamp, Havre, and Trouville.]

ATLANTIC AND MEDITERRANEAN WATERING-PLACES.

The North Sea bathing-places afford in themselves a sufficient choice, and it is enough to mention by name some of the most important southern and western watering-places. Generally speaking, they are distinguished from the North Sea bathing-resorts by higher temperature of air and water, though not all, and by a good local climate. The climate of Naples during the hot season of the year is not very salubrious, and residence in Venice during the summer, and even in September, is rendered dangerous by malaria. The visit of the inhabitant of a southern country to a northern watering-place corresponds, as a rule, far more with the object of a course of sea-bathing, than the visit of the sick inhabitant of a northern country to a southern watering-place.

Atlantic
watering
places.

Biarritz, in the Bay of Bayonne, in the south-west of France, forms a favourable exception, not only by a healthier climate and beautiful neighbourhood and excellent arrangements, but also by allowing sea-bathing till late in the autumn.

Marseilles, Cannes, Nice, Spezzia, Naples, and the Sicilian and the Spanish coasts, can only in exceptional cases be recommended to English invalids as sea-bathing places.

BALTIC SEA WATERING-PLACES.

As we have already mentioned, the Baltic sea watering-places compete with those of the North Sea solely in the enjoyment they afford of modified sea-air, and not at all in the effect of their baths, and still less in their climatic conditions. Compared with a serious course of sea-bathing, they possess rather the importance of summer resorts combined with modified sea-air and cool wave-baths. The principal places are: *Cranz*, *Zoppot*, *Rügenwalde*, *Colberg*, *Dievenow*, *Misdroy*, *Swinemünde*, *Heringsdorf*, *Putbus*, *Warnemünde*, *Travemünde*, *Doberan*, *Düsternbrook*, and *Marienlyst*.

Baltic Sea
watering
places.

CHAPTER IV.

SULPHUR-BATHS.

Uncertainty of theory.

THERE is scarcely any part of balneotherapeutic practice which is so obscured by the contradiction between empirical custom and rational explanation, as the theory and use of sulphur-baths. In frequency of occurrence, and in the age and extent of their use, sulphur-baths have hitherto held the same position as indifferent thermæ, and were only surpassed by sool-baths until recently, when, owing to the uncertain theory of their effect and the rational interpretation of the thermal system, the number of cases suited for sulphur-baths has become considerably limited, and in the explanation of their effect, due importance has been conceded to the warm water, as well as to the sulphur.

Sulphur-baths, which occur in great number as natural thermæ in all parts of the world, were far more abundantly in use in the pre-scientific age than indifferent thermæ; the smell of sulphuretted hydrogen characterised them as sulphurous before analysis was able to prove to what extent. Moreover, sulphur generally at all times played a great part among those pharmaceutic remedies to which important and often mystical effects were ascribed; and even in recent times, since some insight has been gained into the effect of warm baths, no scepticism ventured to approach the supposed sovereign and specific remedy of sulphur-baths; the more so, as the universally introduced use of sulphur in cases of itch and other skin-diseases seemed to place the specific relation of sulphur to the organ of the skin above all question. Added to this, some of the sulphur-baths were among the baths of the first rank as regards reputation and resort, such as Aix-la-Chapelle and several of the Pyrenean baths; and as in both

cases their accompanying properties were left out of the question, namely, the temperature and the amount of chloride of sodium in Aix-la-Chapelle, and the temperature and high mountainous position in the Pyrenean baths, the great reputation of these springs contributed only the more to maintain and increase the reputation of sulphur. At present, on the contrary, the hot sulphur-baths are more and more, with regard to their action, considered nearly as hot springs and appreciated as such according to their position and arrangements.

The reason for this diminished importance lies in the extremely small amount of that substance which, after setting aside the theory of the absorption of the component parts of the baths, can alone support the view of the specific effect of the bath, namely of *sulphuretted hydrogen*. Many sulphur-springs, and even famous ones, contain only traces of sulphuretted hydrogen, and in many cases there is no other proof of its presence than the smell. These traces were over-estimated previously to the time of analyses, because considerable deposits of sulphur were found at the springs, and it was not taken into consideration that these were the product of immense masses of water and of long periods of time, which could not be remotely compared with the quantity and the duration of a bath. As regards the internal use of sulphur, the amount of *sulphuret of alkalies* and *sulphates* must be taken essentially into consideration, as we shall show in the next book; but as regards baths, we have to take in question alone the sulphuretted hydrogen, which proceeds, it is true, from those other sulphurous combinations, but which is found in the springs in about the same proportion, whilst in drinking waters the decomposition taking place in the stomach and intestinal canal acts as a further cause in the production of sulphuretted hydrogen. Whilst, at the point which science has at present reached, we must put out of the question the absorption of the sulphates and sulphurets through the skin, these component parts cannot be taken into account as stimulants to the skin, like the amount of common salt in the soot-baths, because the sulphates so plentifully abounding in other waters have no exciting effect upon the skin, and

Small amount of sulphuretted hydrogen.

because both the sulphates as well as the sulphurets appear so slightly in most sulphur waters, that, with respect to any mechanical irritation of the skin, these are not to be distinguished from indifferent thermæ.

Sulphuretted hydrogen.

If, therefore, *sulphuretted hydrogen* alone remains, as producing the specific effect of sulphur-baths, the question arises as to what quantities of this substance produce the effect in ordinary sulphur-baths. In the springs of Baden in Switzerland, and of Barèges, there is no sulphuretted hydrogen; in Bagnères de Luchon, Cauterets, and other famous sulphur-baths there are only traces of it; in others it appears at 0.05 to 2.4 cubic inches to 16 ounces—for instance, at Eaux-Bonnes 0.05, Langenbrücken 0.06, Weilbach 0.16, Baden near Vienna, 0.08, Teplicz 0.25, Aix-la-Chapelle 0.6, Mehadia 0.8 and 0.9, Schinznach 1.7, Nenndorf 1.18, Eilsen 2, Lubien 2.4, and Töplitz 6.5. We must remark, however, that the latter striking analysis, which was not made by a chemist of any repute, requires revision. The amount of salt in many of these springs characterises them as indifferent; for instance, Barèges has 0.9, Bagnères de Luchon 2.08, Langenbrücken 3.6; others contain somewhat more, as Schinznach 18, Neundorf 13 to 21, Weilbach 11, Lubien 19, Baden near Vienna 14, Eilsen 30, Teplicz 21; but these numbers are for the most part furnished by carbonate and sulphate of lime; and of the effect of lime-waters in the shape of baths we know nothing which can distinguish them from indifferent thermæ, and especially nothing which coincides with the specific effect of sulphur. Others, again, possess not an insignificant amount of chlorine combinations; Baden in Switzerland 13 grains, Aix-la-Chapelle 20, Mehadia from 10 to 59 grains; and in the two former, especially in Baden, the amount of carbonic acid, at any rate, adds to the effect of the bath.

Sulphuret of sodium.

Lastly, with regard to *sulphuret of sodium*, upon which special weight has been laid by the advocates of sulphur-baths, a substance which, as we shall see, is perfectly similar in its effect to sulphuretted hydrogen, we find it amounting in the different springs from 0.04 to 0.6 grains in 16 ounces; and thus the aim of the dis-

cussion is to answer the question as to what effect, if any, baths can exercise, the water of which contains 0.05 to 2.4 cubic inches of sulphuretted hydrogen, or 0.04 to 0.6 grains of sulphuret of sodium; and especially whether this amount of sulphur can establish a claim to be regarded as a vehicle of the supposed specific effect of sulphur-baths. This specific reputation of sulphur-baths, as a glance at the literature on the subject proves, extends over all the cases assigned to indifferent baths, soot-baths, sea-baths, and the cold-water system, and lays claim to producing the same effects in an increased and specific manner. Unfortunately, in the respective bathing-places this general clinical maxim is accepted, and little has been hitherto done towards the explanation of the primary and specific elementary effect of sulphur-baths; and thus the investigation of the above question is limited to the data furnished by pharmacological, toxicological, and accurate clinical observation on sulphurous preparations, data which happily furnish sufficient material.

Sulphuretted hydrogen is one of the most poisonous gases. Its effect is strongest when it is admitted by the lungs, weaker when it is conveyed direct into the blood, and still weaker when it is absorbed by the skin; and from this circumstance it may be inferred that the gas, immediately after its admission, undergoes a rapid decomposition in the blood. The experiments on animals by Falk and Orfila are very instructive, and not less so the observations by Parent-Duchatelet, made on the occasion of the cleaning of the drains at Paris. Air with 1 per cent could be endured without injury; and even with an amount of 3 per cent. for some minutes; the symptoms were the same as had been observed in chemical laboratories, and corresponded with the symptoms of fatal poisoning in experiments on animals; namely, general discomfort, trembling, faintness, giddiness, even clonic spasms and delirium, and diminished frequency of the pulse. Similar observations have been made as to the inhalation of the air over strong gas-springs—for example, in Nenndorf, Eilsen, and Langenbrücken, where, however, unfortunately, the percentage is not stated. The above-mentioned symptoms

Poisonous effect of sulphuretted hydrogen.

were present, though in a slighter degree; but particularly important was the constant occurrence of diminished frequency of pulse, and after some time, and simultaneously with the diminished frequency of the pulse, general perspiration with a perceptible smell of sulphuretted hydrogen. That sulphuretted hydrogen is also admitted through the skin is evidenced by Falk's experiments on fishes, with sulphuretted-hydrogen water, and the well-known experiments on animals made by Lebküchner, Chaunier, and others, in which the dry gas is absorbed by the skin with rapidly fatal effect.

Effect of
sulphur-
etted hy-
drogen in
the bath.

After the above statements, the question arises as to whether, in the elementary and direct influence of ordinary sulphur-baths, there are to be found any symptoms characteristic of the admission of sulphuretted hydrogen into the blood, and which would accordingly prove that an effective dose of sulphuretted hydrogen had been taken up in the bath. The most important of these symptoms, namely, the affection of the nervous system, the diminished frequency of the pulse, and the secretion of sulphuretted hydrogen from the lungs after the bath, would be so plainly and accurately perceived, that their observation and authentication could be subject to no doubt. But we have neither, in the delineation of the immediate effect of sulphur-baths, found any statement whatever which shows any specific effect of sulphuretted hydrogen, nor have we met with experiments which aimed at ascertaining the matter, on the ground of this specific effect.

If simple observation as to the direct effect of sulphur-baths manifests nothing to distinguish these baths from indifferent thermæ, direct experiment will probably yield an equally negative result; and this supposition is strengthened by facts in another branch of practice, namely, in the treatment of the itch. The ordinary sulphur-ointments, sulphur-solutions, and sulphur-soaps contain great quantities of sulphuret of potassium as the effective element, and they evolve not only very much sulphuretted hydrogen, all the conditions for the production of which exist in the usual empirical compositions, but it

is also a fact that the sulphuret of potassium itself, when it reaches the blood, develops sulphuretted hydrogen, and on account of this decomposition produces a poisonous effect.¹ So far as we are acquainted with works on the subject, we have found no case in which the effect of sulphur absorbed from external application has been mentioned, i.e., the *symptoms of this effect*; whilst the absorption itself is frequently presupposed as a matter of course. As early as the year 1844, Hebra published experiments, in which considerable quantities of sulphuret of potassium had been rubbed so strongly and continuously into the much-wounded skin, that a considerable absorption of the remedy must have shown itself in distinct symptoms; nevertheless, with the exception of local appearances of irritation and inflammation, not one of those symptoms was observed which belong to the effect of sulphuretted hydrogen or sulphuret of potassium, when they have reached the blood. Moreover, even the local and irritating effect of the sulphuret of potassium on the skin only appeared in the concentrated ointments and soaps; 10 and 12 per cent. was borne for the most part without irritation, and the erythema which is observed in artificial sulphur-baths with an addition of 5 ounces of sulphuret of potassium, an amount of $\frac{1}{18}$ per cent., is not greater and does not appear more rapidly than the erythema in a warm bath generally. As, however, the ordinary sulphur-springs contain only 0.04 to 0.8 grains in 16 ounces, i.e., at the most $\frac{1}{160}$ per cent. of sulphuret of potassium, very considerable doubt arises even as to the supposed effect of this substance in the sulphur-baths; and this doubt is increased by the limitation of the value ascribed to sulphur as a specific for diseases of the skin, which we shall presently discuss.

Almost always the internal use of sulphur-water is combined with baths, and thus the value of any clinical observation at sulphur-thermæ with regard to the primary effect of the *bath* is diminished. The most famous sulphur-thermæ are used at a tolerably high temperature, and thus their explanation falls under the head of the thermæ generally; and at Aix-la-Chapelle, in addition to the

¹ Hertwig, *Arzneimittellehre*, p. 595.

bath, not only are waters drunk, but frequently vapour-baths are used, so that few individual results are yielded with regard to the effect of the sulphur-bath, as such.

Results.

The result of the above statement may be given in the following points.

1. Sulphuret of potassium, which, when rubbed plentifully into the skin, leaves the latter unirritated at an amount of 5 per cent in the solution, sulphuret of sodium, therefore, cannot be taken into consideration as an irritant to the skin in sulphur-baths containing $\frac{1}{180}$ per cent. and still less as an absorbed remedial agent affecting the blood.

2. There is an utter lack of observations which prove that the sulphuretted hydrogen of the sulphur-baths modifies their effect, and adds a special and powerful influence to the thermal effect. The greater irritation of the skin in sulphur-baths is, for the time being, nothing but an assertion; and this, moreover, is denied by some of the bath-physicians at sulphur-springs.

3. That the sulphuretted hydrogen is absorbed by the skin has, indeed, been long experimentally authenticated and has been proved by constant experience; but hitherto there is an utter lack of observations proving the occurrence of these characteristic symptoms as the effect of sulphur-baths.

4. The possible share also, in the effect of the bath, of the inhaled gas which has escaped above the level of the bath water, has not been ascertained, and is not probable, because, although an infinitely small quantity of sulphuretted hydrogen, in fact even a trace of it, strongly affects the nerves of smell, the gas really hardly rises from the water. It is only in some especially strong springs, such as Eilsen and Nenndorf, that important symptoms of inhalation have been observed; yet even these observations are of too isolated a character not to require confirmation. Possibly, we may suppose that in the Piscines (swimming-baths), which are usual in the Pyrenean baths, so much gas escapes from the mass of water and from its violent agitation, that its inhalation may co-operate in the treatment. There is, indeed, a lack of definite statements on the subject, but the supposition is somewhat

confirmed by the old experience that these Piscine baths produce a stronger effect than simple tub-baths.

5. On the whole, therefore, we arrive at the following conclusion. As it will be proved that the class of cases adapted for sulphur-baths concur almost entirely with those suited for indifferent thermæ, so the explanation of their general effect must rest for the present on the effect of the warm water, until a proof can be furnished as to whether and in what manner the small amount of sulphuretted hydrogen modifies this effect. The result of the empirical examination of the ordinary uses corresponds entirely with this negative and theoretic position of the question.

EXAMINATION OF CLASSES OF CASES.

1. *Skin-Diseases*.¹ — If we recur here once more to the chronic exanthemata, we do so for two reasons. In the first place, sulphur-baths are still always regarded as a general panacea for diseases of the skin, and this reputation is based entirely on error; in the second place, however, the theory as to the effect of sulphur-baths is in general accustomed to start with their sanative power in skin-diseases, and thus to rest on a fact which is very doubtful. The tenacity with which this error is maintained forcibly shows how difficult it is for the indolence of custom to extricate itself from old maxims, although these are neither based upon theory nor experience. We follow Hebra in our examination of the subject, because the teachings of this great practitioner agree with the result of our own experience and with that of other unprejudiced observers.

The advocates of sulphur-baths and sool-baths appeal with especial predilection to *pustular eruptions*, in order to prove the power of their remedies. They prove, in truth, nothing by so doing; for on the one side it lies in the nature of a pustule, i.e., of a true skin-abscess, to yield to any treatment which matures the abscess, and among others to moist warmth; on the other side, however, the pustular skin-diseases specified by the authors under

¹ See p. 111 *et seq.*

the names of impetigo, ecthyma, porrigo, achor, &c., do not, as Hebra maintains, exist at all as independent diseases; they are only the accompaniments or results of other skin-diseases, the diagnosis of which is rendered possible by other characteristic phenomena, and this generally long before any pustular eruption has appeared.

Scabies.

The *itch* does not come into consideration under our present subject, because sulphur is only so far of use in it that it kills the mites, and because, in the treatment of the disease, the necessity of strong sulphur-remedies is sufficiently popular for the rejection of all faith in the effect of natural sulphur-springs, the amount of sulphur in which, compared with the itch remedies, is limited to a homœopathic quantity.

Acne
rosacea.

Sulphur has an undisputed reputation in the treatment of *Acne rosacea*, but only in the first stages of this disease, before it has arrived at the formation of telangiectasis. Solutions of sulphuret of potassium in soap, ointment, water, and in nostrums, such as the Kummerfeld wash, and always in such strongly concentrated quantities that they produce an almost cauterising effect, are required, and the small doses of sulphur in the sulphur-waters are useless.

Psoriasis.

The case is similar with some other skin-diseases, in the treatment of which sulphur has occasionally proved efficacious; such as *Acne disseminata*, *Prurigo*, and *Psoriasis*. In these cases also it is only *strong* compositions that have proved efficacious—compositions containing an amount of sulphur a hundred or a thousand times greater than that found in natural sulphur springs. How rarely acne is cured, and when this is the case, what perseverance is required, is generally known. After all that we have said, it is evident that the reputation of sulphur-thermæ, as such, belongs to the realm of fable as regards skin-diseases, and this all the more as the simultaneous-internal use of sulphuretted water has also proved inefficacious in cases of exanthemata.

Rheuma-
tism and
gout.

2. *Rheumatism, Gout, and Exudations*, and all conditions generally in which the cold water and the thermal

systems are intended to accelerate change of substance, and to promote absorption.

In these cases a greater and specific effect is ascribed in general to sulphur-baths, especially in comparison with indifferent thermæ. It is true, up to the present day we lack all scientific proof as to the quantity and quality of this specific effect, and even as to the absorption of sulphuretted hydrogen in baths of the natural sulphur-thermæ; still the effect of the latter in these cases is not to be denied, and equally little is it to be disputed that the internal use of sulphur-springs frequently powerfully assists the effect of the baths. Nevertheless, the bad prognosis of gouty and rheumatic exudations, stated in the preceding book, still holds good, in spite of the existence of sulphur-thermæ; and a general and empirically based preference of the latter over Wiesbaden, Teplitz, and other thermæ, or even any qualitative difference in their effect, has been in no wise actually proved, but is only simply asserted, without being borne out by any accurate particulars. Special climate and special treatment establish a preference very often for a certain bathing resort in an individual case, but this is often only empirical and a matter of experiment. We have, for instance, seen cases of obstinate muscular rheumatism of long standing, unaffected by Teplitz, Gastein, or Wiesbaden, which have been cured at Aix-la-Chapelle by vigorous treatment, composed of tub-baths, vapour-baths, and a course of waters; but on the other hand also cases in which the sulphur-bath has proved ineffectual, and which found relief from another thermal spa or from the cold-water system.

The physicians at sulphur-thermæ ought to investigate and authenticate the existence and the amount of any specific *sulphurous effect* in their *baths*; so long as this is not the case, they will be regarded as indifferent thermæ, and the results of their use must be referred to the thermal effect generally, combined with the internal use of sulphurated water, and the inhalation of the gas over the *spring*, but not over the tub-bath.

3. *The treatment of Paralysis* and other cases of *Neuroses*. *neuroses* is to be estimated according to the rules ad-

duced with regard to the thermal system in the preceding chapter.

Syphilis.

4. *Syphilis and latent Syphilis*.—As we already mentioned in the first book, page 145, sulphur-baths lay claim to great efficacy in curing evident syphilis, and in making latent syphilis manifest a claim which is in no wise based on truth. The little that thermal springs can effect in cases of syphilis, belongs also to sulphur-thermæ; and the manifestation of the latent disease by means of the specific power of sulphur-baths, is, in our eyes, and in the opinion of Hebra and others, nothing but humbug.

Metallic
poison-
ings.

5. *Chronic Metallic Poisonings*.¹—The effect of sulphur-waters in chronic metallic poisonings, especially those from lead and mercury, is regarded in medical practice as indisputable, and theory seems naturally to explain the empirical fact. In cases of acute poisoning, the sulphur, by forming insoluble combinations, is intended to prevent the direct local effect and the absorption of the poison; in cases of chronic poisoning, it is intended to promote the solution and excretion of the metal deposited in the organs. The results are, however, by no means brilliant. Some persons paralysed from metallic poisoning are quite cured, some improved by the sulphur-waters, many remain unaffected. Each external and internal system of water-treatment yields similar results; the only undisputed fact is the sanative power of sulphur-waters, internally taken; but with regard to the specific effect of sulphur-baths, there is an utter lack of all comparative and accurate observations.

Tanquerel
des
Planches.

The implicit faith placed by many in *sulphur-baths*, is based on the observations of Tanquerel des Planches,² that in several cases of lead-poisoning, sulphuret of lead has been found on the skin after the sulphur-bath; it was, however, forgotten that the persons in question were only plumbers, who had continued their employment up to the time of the treatment, and that therefore preparations of lead had accumulated in the furrows of the epidermis, and there could have combined with the sulphuret of potassium or with the sulphuretted hydrogen of the bath. Tanquerel, moreover, describes

¹ See p. 72.

² *Traité des Maladies de Plomb*.

the effect of the sulphur-bath in a similar manner to that which we recognise generally as the primary effect of the warm-water bath, namely, lightness of the limbs during the bath and some hours after it; and in a scientific point of view we scruple to assume that in so short a period the sulphuretted hydrogen absorbed through the skin, according to Tanquerel's supposition, should decompose, dissolve, and excrete the lead deposited in the substance of the nerves, and that the fibres of the nerves, which had been injured for years, should immediately discharge their normal office.

From an early period, lead-neuroses have been ascribed to the local deposit of lead in the substance of the brain, the spinal marrow, and the fibres of the nerves. This deposit has been assumed as a matter of course, a few corresponding results from rude chemical investigations have been eagerly welcomed, and the lack of all reliable analysis by chemical and anatomical authorities has been ignored. According to all accurate investigations, the liver (and rarely the spleen) is the organ in which lead and quicksilver are deposited, and from which they are excreted with the bile. How they, through this and through the blood, produce an effect on the fibres of the central nerves, has hitherto not been ascertained; but that other explanations are possible, besides those of a mechanically chemical theory, has been proved by a case of lead-paralysis which we saw with Remak, and the intended publication of which was prevented by Remak's death soon afterwards. This was an indubitable case of lead-paralysis, affecting the extensor muscles of the arm and hand; these, as well as the flexor muscles, were affected with violent trembling whenever the sick person stretched out his arm and held it extended. The trembling ceased, however, immediately, and the extension became normal and tonic, as soon and as long as a constant current was directed to the abdominal portion of the sympathetic. An observation of this kind suggests the view that possibly these kinds of paralysis may belong to the reflex paralyses in Romberg's sense, a supposition which is strengthened by the fact that lead-paralysis is very frequently preceded by lead-colic.

Seat of
lead-neu-
rosis.

Explan-
ation of
treatment.

The excretion of the metal from the liver (the spleen and the blood) by means of the natural change of substance, is the explanation of the more or less tardy natural cure of metallic poisoning, and this explanation corresponds with accurate experience. The excretion by means of artificially accelerated change of substance is the explanation of the effect of those methods of treatment which have been proved beneficial in these poisonings; and among these approved methods all those remedies, besides sulphur-baths, may be numbered which powerfully promote the change of substance; all thermæ, sool-baths, and especially lixiviating cold water cures, and Teplitz, Carlsbad, Wiesbaden, and hydrotherapeutic treatment, rival Aix-la-Chapelle and the Pyrenean baths in actual and numerous successful results. If, with other active practitioners, we sum up the results of our experience of cases recorded, we must confess that sulphur-baths, as baths, have no advantage above other methods; on the contrary, this advantage belongs in truth to the internal use of sulphur, which generally accomplishes the object more rapidly than a course of baths, and just as rapidly as strongly lixiviating waters taken in a course of drinking. In this internal application, we may of course reckon also the inhalation of sulphuretted hydrogen, either over the springs or over baths artificially prepared with sulphuret of potassium and sulphuric acid; and the direct transition of sulphuretted hydrogen into the blood, and especially into the blood of the mesenteric vein, and the destroying influence which it exercises upon the cells (see the following book upon courses of waters), readily explain this effect. Unfortunately, accurate investigations respecting the chemistry of the effect are lacking. The urine affords but little information; this is probably far rather to be sought for in the *feces*.

In the above pages, instead of the chemical theories and indications usual in balneological works, we have stated in detail all that we know and do not know with regard to the effect of sulphur-baths, as a guide to future investigations. The general result is this: 1. The small

amount of sulphurets is a matter of indifference, because absorption of them in the bath is neither proved nor probable according to the present stage of science. 2. The amount of sulphuretted hydrogen is in most baths very slight, and its absorption in the bath is not proved, at least no physiological symptoms are recorded. 3. It therefore remains for the future to ascertain whether the usual sulphur-springs, used as *baths*, are more than in-different thermæ.

A. SULPHUR-BATHS IN THE PYRENEES.

The sulphur-baths of the Pyrenees are among the most famous baths. From an early period names such as Barèges, Eaux-Bonnes, Bagnères de Luchon, and Cauterets are universally known. They are much visited in France, and the indications as to the use of sulphur-springs may be traced to them.

General
remarks
upon the
Pyrenean
baths.

None of these springs contain any amount of chlorine combinations or of carbonic acid; and, in comparison with German sulphur-springs, they have only traces of sulphuretted hydrogen, and indeed only a few grains of any fixed component parts, but these in such proportions of sulphuret of sodium, sulphuret of iron, sulphates, and silica, that the conditions required for the decomposition of the sulphurets and for the formation of sulphuretted hydrogen exist in them. It is an almost constant phenomenon in these and in other sulphur-springs that this decomposition increases on contact with the air; the water becomes opalescent and for some time evolves more sulphuretted hydrogen, until the decomposition ceases and the water again becomes clear; but there is a lack of analytic investigations of the bath-water in the tubs after long standing. Piscines are very usual in the Pyrenean baths, i.e., large basins for several persons, who move about in them and even swim, and in the air above one of these in Bagnères de Luchon an amount of more than one per cent. of sulphuretted hydrogen has been found, a quantity which, inhaled into the lungs, may indeed produce a considerable effect. Nevertheless, we have in vain sought

for accurate statements as to this effect and its manifestations; and the universal predilection enjoyed by piscine-baths at Bagnères and Barèges in cases of gunshot wounds, fractures, &c., may be well explained by the movement of the body in the bath.

Referring to the next book for our remarks on courses of drinking-waters, we will only here observe that in the ordinary classes of cases adapted for Pyrenean baths all the conditions are found which are suited to indifferent thermæ, obscured to some extent by French balneological literature, which still more than the German delights in minute clinical distinctions and emphatic declamations.

Most of the Pyrenean baths are natural baths ('Wild-baths,' 'Wildbäder'), i.e., thermæ in high mountainous situations, and some of them with very rough climate. One is famous as a panacea against scrofula, another against catarrh of the lungs and tubercles, another against the consequences of traumatic injuries, and another against amenorrhœa; and the faith in the special powers of these waters is so great that the course of waters at Eaux-Bonnes in many cases begins with a tablespoonful, and this with a water which contains 2·6 grains of chloride of sodium, 2 grains of other salts, and 0·18 cubic inches of sulphuretted hydrogen to 16 ounces. In general, the baths in the Pyrenees are taken at a high temperature and the piscine-baths seem more efficacious than any other. The best known of these bathing resorts are the following.

Eaux-
Bonnes.

Eaux-Bonnes, department Basses-Pyrénées, 2,300 feet above the level of the sea, situated in a narrow ravine, at the foot of the Pic du Ger, subject to great changes of temperature during the day, and rich in grand natural beauties, is less used for bathing than for courses of drinking; the latter are found to produce such grand results in tubercles of the lungs, pharyngitis granulosa, pleuritic exudations, asthma, and hepatisation of the lungs, that the French suppose that the effect is due to some as yet unknown element in the otherwise very poor water. 'Il y a certainement quelque autre agent qui nous échappe.' However, some of the physicians of the place, Schnepf and Pietra Santa, feel themselves now in truth

obliged to attribute the principal effect of Eaux-Bonnes, in tuberculous cases, to the high situation of the place.— (Drs. Leudet, Manes, Pidoux.)

Eaux-Chaudes, department Basses-Pyrénées, situated further on in the valley of Eaux-Bonnes, and close to the latter place, in a wild ravine, 2,100 feet above the level of the sea. It is less used for drinking, but chiefly for bathing, especially in cases of muscular rheumatism and chlorosis. (Dr. Lémonier.)

Eaux-Chaudes.

Penticouse (Ponticosa) in Spain, situated some miles from the French frontier, and to be reached within 10 hours from Eaux-Chaudes, is very interesting as one of the highest spas in Europe, and from its confirmation of the principle laid down in the first chapter, that residence in a high situation facilitates change of substance and all functions, and that therefore stimulants can be all the better borne the higher the spa. The statements as to the height of the situation vary considerably. Earlier ones give 7,200 feet; recent and probably more correct authorities give 4,900 to 5,475 feet. Persons with affections of the chest drink daily, as a rule, 25 to 30 glasses of the spring, at 25 to 33° Cent. (77 to 91·4° Fabr.), and rich in nitrogen and sulphuretted hydrogen, without experiencing any excitement and reaction, but, on the contrary, with a quieting effect on the vascular system. (Dr. J. Herrera y Ruiz.)

Penticouse, the highest spa.

Cauterets, department Hautes-Pyrénées, about 3,200 feet above the sea, in a narrow winding valley. The climate is variable in accordance with the mountainous position, and the air pure. It is much frequented, especially by persons suffering from affections of the chest. The drinking of the waters predominates, but it is, for the most part, combined with baths, and is specially famous in cases of chronic bronchial catarrh, especially the Raillère spring. This contains 1·19 grains of component parts in 16 ounces; among them 0·14 sulphuret of sodium, 0·3 sulphate of soda, 0·3 chloride of sodium, 0·4 silica and traces of sulphuretted hydrogen. If we reflect that the usual pharmaceutical dose of sulphuret of sodium is 20 to 50 times greater than the whole

Cauterets.

amount of this substance in 16 ounces, it is surmised by the French physicians that the quantity of sulphuretted hydrogen sufficient to produce such effects is developed in the stomach and intestines from the sulphuret of sodium acted upon by the comparatively large quantity of silica. Whether this supposition is well founded has not been proved by observations, and it still remains a question whether the warm water of 39° Cent. (102·2° Fahr.), combined with the high situation of the baths, does not produce the effect on the bronchial membrane. It is especially difficult to conceive how this small amount of mineral elements, even with horses, whose diseases, compared with those of men, require enormous doses of medicine, should in the course of eight days produce the striking effect which is every year to be seen at Cauterets; horses from the studs at Tarbes and Pau, which are afflicted with chronic bronchial and stomach catarrh, diarrhœa, emaciation, and spermatorrhœa, are sent to the springs at Cauterets, and are often cured there in a week. Such facts may be ascribed with great probability, and almost necessarily, to the height of the situation, as the active principle. (Drs. Cardinal, Guinier, Gigot-Suard.)

Saint-
Sauveur.

Saint-Sauveur, department Hautes-Pyrénées, furnishes a striking example of the affinity between sulphur-thermæ and indifferent thermæ. On account of its very simple spring of moderate temperature (34·2° Cent., 93·56° Fahr.), its high situation (2,360 feet), and its mild climate, it is a natural bath (a 'Wildbad') in the true sense of the term; and the class of cases for which it is prescribed accord entirely with those suited to the German natural baths (Wild-baths), such as Gastein, Wildbad, and Schlangenbad. Saint-Sauveur is predominantly the French ladies' spa. Neurosis, attended with irritable weakness and the consequences of sexual diseases, form the principal cases. (Drs. Charmasson de Puylaval, Fabas.)

Barèges.

Barèges, department Hautes-Pyrénées, over 4,000 feet above the sea, with a rough climate, and brought into fashion through Madame de Maintenon, since the year 1675, is the most famous of the Pyrenean spas. The visitors consist principally of paralysed persons, and those

suffering from diseases of the bones and from wounds, and the most usual remedies prescribed are douches and piscine baths, the mechanical motion of which, perhaps combined also with inhalation of the sulphuretted hydrogen which is thus increased, probably produces the specific effect. The piscine baths are especially extolled for the rapid ejection of foreign bodies and sequestra. The nitrogenous organic and gelatinous substance which appears in almost all sulphur-thermæ, derives from Barèges one of its numerous names, barègine. The springs have a temperature between 31 and 45° Cent. (87·8 and 113° Fahr.), and are poor in solid constituents. [During the months of July and August the crowding of Barèges is excessive. Invalids frequently must leave their beds soon after mid-night to take their turn at the baths; and the air in the piscines, owing to the small cubic space allowed to every bather, is almost intolerable.] (Drs. Grimaud, Vergez.)

Bagnères de Luchon, department Haute-Garonne, is in every respect one of the most beautiful of the Pyrenean spas. It has a mild climate; it is beautifully situated in a broad valley, in the neighbourhood of the grandest scenery, at an elevation of over 2,000 feet; it has a great abundance of springs between 17·5° and 56° Cent. (63·5 to 132·8° Fahr.), containing double the mineral value, compared with the spas hitherto mentioned; it possesses excellent establishments, and affords an agreeable and amusing life. The thermæ were known even in the time of the Romans, and the new magnificent bath-house is built over the Roman baths. The use of the springs combines that of all sulphur-thermæ, and, in spite of the fact that in the springs themselves there are only traces of sulphuretted hydrogen to be found, so great a quantity of this gas, as we have already mentioned (page 272), escapes from the water of the great swimming-bath, that the air above contains more than 1 per cent. of it. The cause of this decomposition is considered to be the silica, in combination with the atmospheric air; and in truth the water of Luchon is very quickly decomposed and becomes milky as soon as it is drawn from the spring; an appearance

Bagnères
de Luchon.

which occurs, however, more or less, in all Pyrenean springs. (Dr. Lambron, and other physicians.)

Az.

Az, department Ariège, about 2,300 feet high, has, like Bagnères de Luchon, a great abundance of springs, which are subject to equally rapid decomposition, and are equally well situated, though not by any means so much frequented as Luchon. (Drs. Auphan and Bonnal.)

Vernet.

Vernet (or *Le Vernet*), about 2,000 feet high, department East Pyrenees, at the foot of the Canigou, possesses a mild climate; and partly for this reason and partly because suitable arrangements are made for baths and inhalations during the winter, this spa is visited also in the winter, especially by persons of delicate chest. (Drs. Piglowski and Vialane.)

Amélie-les-Bains.

Amélie-les-Bains, 680 feet high, department East Pyrenees, close to Arles and Perpignan, with comparatively strong and very warm springs, and manifold arrangements for the most different forms of baths and bath temperatures, inhalations, vapour-baths, and steam-baths; especially visited therefore by rheumatic sufferers, and by persons of delicate chest, and this also during the winter. (Drs. Genieys and Pujade.)

Aix-les-Bains.

Amongst the sulphur-baths in other parts of France, a prominent place is occupied by *Aix-les-Bains*, in Savoy, three miles from Chambéry, 790 feet high, situated in a picturesque valley in the vicinity of the grandest parts of the Alps, frequented even in the time of the Romans, and now a spa of the first rank. The springs, 42 to 45° Cent. (107·6 to 113° Fahr.), are immensely rich, and the arrangements and methods are adapted with the utmost suitability and perfection for the stimulating forms of the thermal system; hence the usual indications for cases of rheumatism, gout, and paralysis correspond with those of Teplitz, Wiesbaden, and the exciting forms of the cold-water system. The life is as fashionable as in the most frequented German baths; but it is a drawback that the bath-arrangements are not sufficient for the great number of visitors during the most crowded months, so that many sick persons have to take their baths from 2 to 3 o'clock in the morning.

[Not far from Aix-les-Bains are the cold sulphur-springs

of *Marlioz*, which are specially used for inhalation, and may be considered as belonging to Aix-les-Bains. (Drs. Bertur, Blanc, Davat, Macé, Vidal, and several others.)

St. Amand (Nord) has cold sulphur-springs and sulphur-mud. (Dr. Isnard.)

Englien is a good cold sulphur spring, in the department Seine-et-Oise. (Dr. de Puisaye.)

Uriage, in a beautiful situation, about 1,300 feet above sea-level in the department Isère, near Grénoble, is a saline sulphur spring, temp. 80° Fahr., with 7 parts of common salt in 1,000 water.—Dr. Doyon.]

B. GERMAN SULPHUR-BATHS.

Aix-la-Chapelle, 534 feet high, much frequented, with arrangements and mode of life corresponding equally with the most luxurious requirements and the smallest finances, is the main representative of the German sulphur-baths. The amount of sulphuret of sodium in the springs is small, compared with the Pyrenean baths; that of sulphate of soda is somewhat greater, and silica exists in a similar quantity; the amount of sulphuretted hydrogen is greater than in most Pyrenean springs, being about 0.6 cubic inches to 16 ounces; and in addition to this, there is an amount of *chloride of sodium* from 19 to 20 grains, and of carbonate of soda from 3 to 5 grains. This combination is of great importance for courses of drinking.¹ With regard to baths and their estimation, however, we must take principally into consideration the *method* used, which, as in most of the old-established and much-frequented spas, has become almost a rule and essentially contributes to the effect. This is the combination of warm baths of 34° to 35° Cent. (93° to 95° Fahr.), of half to three-quarters of an hour in length, with vapour-baths, douches, and with the drinking of the mineral water, which contains common salt, and is 54° Cent. (129.2° Fahr.) warm. Thus we have at Aix-la-Chapelle under treatment by the strong thermal system, combined with the internal use of sulphur and salt water, many cases of rheumatism, gout, paralysis, metallic poisoning, and abdominal derangement. What we are to think of the

Aix-la-Chapelle.

¹ See following book.

reputed efficacy of the Aix-la-Chapelle baths in cases of apparent and latent syphilis, has been stated at pages 145 and 276, and we there also remarked that for the present we lack all observations which might place the specific effect of the sulphur of these baths beyond a doubt. In the hope that in Germany accurate investigations may soon be directed to this question, we give the exact analysis of the German springs, in order to enable the reader to compare and appreciate any observations on the matter, on the ground of their chemical constitution; otherwise, we have intentionally passed over those component parts, which in their small proportion cannot influence the effect of the bath. The *Kaiserquelle*, at Aix-la-Chapelle, which is especially used for drinking, is but slightly different from the others, and may therefore be taken as a specimen. It contains in 16 ounces—

	Grains.
Chloride of sodium	20.2705
Bromide of sodium	0.0276
Iodide of sodium	0.0040
Sulphuret of sodium	0.0729
Carbonate of soda	4.9950
Sulphate of soda	2.1712
Sulphate of potash	1.1861
Carbonate of lime	1.2173
Carbonate of magnesia	0.3952
Carbonate of strontia	0.0016
Carbonate of the protoxide of iron	0.0733
Carbonate of lithia	0.0022
Silica	0.5077
Organic matter	0.5733

Temperature, 54° Cent. (129.2° Fahr.).

(Drs. Brandis, Kilian, Lersch, Mayer, Reumont, Schuhmacher, Wetzlar, Ziemssen, Zurhelle, and other practitioners at Aix-la-Chapelle.)

Burtscheid, situated close by Aix-la-Chapelle, with springs of similar composition, but of higher temperature, and with a smaller amount of sulphur.

Baden, near Vienna, station on the Austrian Southern Railway, situated in the beautiful broad valley by the Wiener Wald (Viennese forest), possesses all the advantages of a fashionable spa, in the vicinity of a capital. The diseases are of the same nature as those treated at Aix-

art-
heid.

don,
ar
ennn.

la-Chapelle, yet cooler baths, down to 22·5° Cent. (72·5° Fahr.), are frequently given. The two most important springs contain in 16 ounces—

	Grains.	Grains.
Chloride of sodium	1·990	and 2·265
Chloride of magnesium	1·615	„ 1·514
Sulphuret of magnesium	0·125	„ 0·118
Carbonate of soda	0·532	„ 0·052
Sulphate of soda	2·128	„ 2·576
Sulphate of potash	0·489	„ 0·566
Carbonate of lime	1·305	„ 1·593
Silica	0·185	„ 0·219
Sulphate of lime	5·656	„ 5·547
Organic matter	0·043	„ —
Total	14·068	„ 14·450
Sulphuretted hydrogen	0·082	„ 0·672

Temperature, 35° Cent. (95° Fahr.) and 34° Cent. (93·2° Fahr.).

(Drs. Frommer, Gerber, Habel, Heinz, Kirscher, Lucas, Rollet.)

Baden in Switzerland, in the Canton Aargau, in the Limmat valley, reached in 20 minutes from Zürich by means of the railway, is a much-frequented spa with good arrangements. The numerous springs, 47·5° to 50° Cent. (117·5° to 122° Fahr.), warm, were formerly regarded as sulphur-thermæ, because they smell of sulphuretted hydrogen. In the water itself there is no perceptible quantity of this gas; it is formed, however, in the course of the spring to the bath-reservoirs, from the decomposition of the sulphate of lime, and perhaps, also, of the organic substance (barégine); in what quantity has not been ascertained. They contain about 30 grains of component parts, among them 11 grains of sulphate of lime, 15 grains of chlorine combinations, no sulphurets, and only traces of silica, but a moderate amount of carbonic acid and nitrogen gas. The most usual cases adapted to these baths are the same as for the strong thermal system, and, accordingly, protracted and very warm baths are selected. The height of the situation is 1,180 feet; the climate is extraordinarily mild, and admits of winter treatment; and the life is cheap. (Drs. Minnich, sen. and jun., Nieritzer, Schmid, Schnebeli.)

Schinz-nach, Canton Aargau, 1,080 feet high, mild

Baden in
Switzer-
land.

Schinz-
nach.

climate, two hours from Baden, station on the Swiss North-East Railway. The spring is 35° Cent. (95° Fahr.) warm, and contains more sulphuretted hydrogen than all the spas of the Pyrenees; nevertheless, no specific influence is perceived from the direct effect of the baths, which can be ascribed to the sulphur.¹ [The temperature is not always the same, being sometimes lower; the baths are usually warmed, and their duration not rarely extends from 1 to 2½ hours.—Drs. Amsler and Hemmann.]

Lavey.

[Among thermal sulphur spas we may mention *Lavey* in the Rhone valley, near the station St. Maurice; elevation about 1,350 feet. The air is in summer rather oppressive, but much better in spring and autumn. The temperature of the water is likewise not constant, owing to the situation of the sources near the Rhone; it varies between about 92° and 113° Fahr. The water contains a moderate amount of chloride of sodium and sulphate of soda; and sool-baths are prepared by means of mother-lye from Bex.—Dr. Cossy.]

[*Landeck*, frequently mentioned amongst the hot sulphur-baths, has been placed under the head of indifferent thermal baths; the same might have been done with *Baden* in Switzerland.]

Cold sulphur-springs in Germany.

Eilsen, *Neundorf*, *Langenbrücken*, and *Weilbach* are cold sulphur-springs, and are used for drinking as well as for baths; *Weilbach* especially for the former. The amount of sulphuretted hydrogen contained in the three first-named is considerable—0·4 to 1·5 cubic inches,—and on the artificial warming of the water it does not escape by far so readily as the carbonic acid; nevertheless, here also no specific effect has been observed from the sulphuretted hydrogen absorbed by the skin, though the *inhalation* of the sulphuretted hydrogen above the spring and above the level of the bath produces results which cause great importance to be attached to inhalation. In drinking, also, there are none of the characteristic and immediate effects of sulphuretted hydrogen to be observed, and accurate investigations will perhaps prove, that to produce any powerful effect from sulphuretted hydrogen, the surest

¹ See p. 270.

method is to receive it through the lungs; and, therefore, by *inhalation*.

Eilsen, in the principality of Bückeburg, 273 feet Eilsen.
high, situated in a pleasant wooded valley, is a small spa not much frequented. The springs contain from 8 to 21 grains of component parts, among them 5 to 13 grains of sulphate of lime, 0.1 to $4\frac{1}{2}$ grains of sulphate of magnesia, and somewhat more than 1 grain of silicate of soda, and 1.16 to 1.5 cubic inches of sulphuretted hydrogen; for the further formation of which in the stomach and intestines, favourable conditions are presented by the proportions of the sulphates and the silica. The great amount of bicarbonate of protoxide of iron of from 0.4 to 0.9 grains, seems not to be taken into consideration in sulphur-waters as regards any possible effect from the iron, as the iron is speedily and perhaps entirely changed into sulphuret, and is carried away with the fæces. Besides inhalations and baths, *mud-baths* are also abundantly used. (Drs. Möller, Schöniar, and Wegener).

Nenndorf, in the former electorate of Hessen, is Nenndorf.
situated in a pleasant woody country. It possesses excellent arrangements, and is an hour from the Haste station on the Minden and Hanover Railway. It has sool-baths (p. 231) and mud-baths. The springs contain 0.4 to 1.18 cubic inches of sulphuretted hydrogen, 5 to 8 grains of sulphate of lime, 3 to 4 grains of carbonate of lime, 2 grains of sulphate of magnesia, 2 to 5 grains of Glauber's salts, 0.01 to 0.16 grains of silica, and 4 to 8 cubic inches of carbonic acid, which comes into consideration when used for drinking. (Drs. Grandidier and Neupel.)

Langenbrücken, in Baden, 440 feet above sea-level, Langenbrücken.
between Bruchsal and Heidelberg. The springs are poor as regards component parts, but they are rich in carbonic acid, and they contain 0.131 to 3 cubic inches of sulphuretted hydrogen gas. Tub-baths, douches, vapour-baths, vapour douches, and dropping baths are used, and thus a strongly stimulating thermal system, both of a general and local character, prevails; hence this spa is chiefly resorted to in rheumatic cases, the treatment of which is

aided by the mild climate. The accommodation is rather limited. (Dr. Walther.)

Weilbach.

Weilbach in the Prussian province of Nassau, situated in the valley of the Main on the eastern declivity of the Taunus, was considered by Schoenlein to possess great advantages for internal courses of sulphur water; and will be further mentioned in the next book. The spa consists of an isolated bath-house; it is connected by railway with Höchst, Hochheim, Mainz, Frankfurt, and Wiesbaden, and can be reached in an hour. The quantity of sulphuretted hydrogen amounts to 0.16 cubic inches. The waters are more used for drinking and inhalation than for baths. (Dr. Stiff.)

Similar, but still weaker springs, are those of Boll and Reutlingen in Würtemberg; and, besides these, there are in other countries a number of local sulphur-baths, in the internal use of which it frequently becomes a serious question whether they are not *marshy springs*, containing, besides sulphuretted hydrogen, other organic products of decomposition; so that, consequently, they may be the vehicles of malaria and other injurious influences. Among these, we may reckon the peasant spa of Fiestel near Minden, which some years ago fell into the hands of a swindling company, and was appropriated to a fraudulent lottery undertaking.

[*Meinberg*, in the principality of Lippe Detmold, is another weak sulphur-bath, where baths of sulphur-mud are much used. A *chalybeate spring*, rich in carbonic acid, and a *salt spring*, increase the remedial resources of Meinberg.—Drs. Caspari and Kirchner.]

[*Stachelberg* in the Canton Glarus, in Switzerland, 2,050 feet above sea, possesses but a weak cold sulphur-spring; but it offers by its beautiful position in the Toedi district, and by its cooler summer climate, considerable advantages.—Dr. König.]

[The *Heustrich* bath, about 2,000 feet, on the slope of the Niesen, and the Spa *Gurnigel*, 3,550 feet, near the Stockhorn in the canton of Berne, are only of local importance.]

[*England* possesses various sulphur-springs, but they

are not much used, with the exception of the sulphur-wells at *Harrogate*, which are of different strength with regard to the amount of sulphuretted hydrogen and sulphuret of sodium contained in them; but which all owe, in great part, their action on the body to their saline elements (see p. 265). Dr. Macpherson, in his valuable work on the mineral waters of the British islands, will be consulted with great advantage by all those who wish to avail themselves of the numerous English spas, hitherto more or less neglected. Wales has likewise sulphur-wells, in which, however, the saline ingredients again play an important part. Thus, the wells of *Llandrindod* are designated by Dr. Macpherson as *mild Harrogate waters*; at *Builth* the 'sulphur-well' seems to be very weak, while the saline one contains 66 grains of common salt; but one of the springs at *Llanwrtyd* in South Wales is described as containing in 20 ounces only eight grains of common salt, and 0.62 inches of sulphuretted hydrogen. The climate at all these places offers advantages; and, as the accommodation is improving, they may gradually acquire real importance as spas.

Scotland has many sulphuretted wells, but the arrangements are generally so imperfect, that they can scarcely be recommended to invalids. Rather more may be said, however, in favour of *Moffat* and of *Strathpeffer*.

Moffat, in the upper part of Annandale, is about 400 Moffat. feet above sea-level; the climate is good, and the country offers agreeable excursions. The water is said to contain more than $2\frac{1}{2}$ inches of sulphuretted hydrogen in the pint, together with 22 grains of chloride of sodium and 2 of sulphate of soda. The water is cold, and is principally used internally.

Strathpeffer, likewise a cold sulphur-spring, in a beautiful neighbourhood in Ross-shire, has several springs. The Strath-
peffer. new well, we are informed, contains about three cubic inches of sulphuretted hydrogen, 16 grains of lime-salts, and 7.5 of sulphates of magnesia and soda. The action of the water (4 to 6 tumblers per day) is rather constipating.

Ireland is also provided with sulphur-wells, but scarcely any of them are methodically used, with the exception of

Lisdun-
varna.

Lisdunvarna, in the west of Ireland, about 20 miles from Ennis, in a bare country. We have heard much of Lisdunvarna, but the arrangements, according to Dr. Macpherson's account (*op. cit.* p. 187), are not yet very inviting. The sulphur-water is said to contain $\frac{1}{2}$ inch of sulphuretted hydrogen. Lisdunvarna possesses, besides, several pure chalybeate springs of moderate strength, and, with improving social arrangements, it may therefore in time offer great advantages.]

C. THE EUGANÆAN THERMÆ.

Euganæan
Thermæ.

Between Padua and Vicenza there stretches the hilly range of the Euganæ, volcanic elevations, from which numerous hot springs gush forth, similar in their combination to the springs of Aix-la-Chapelle, but containing double as much common salt as these, besides more carbonic acid and about the same quantity of sulphuretted hydrogen. Ever since the time of the Romans these springs have been in constant use, and may be recommended as thermal waters even to German and English invalids. The arrangements at some of them are good, and the country and climate exquisite. The most frequented of these baths is *Battaglia*, and the next *Abano*. Besides tub-baths, local mud-baths are especially used.

[The temperature of the different springs at *Battaglia* varies from 73·7° to 160° Fahr. The arrangements at this place have of late been much improved by the present proprietor of the springs, Count Victor Wimpffen. Both *Abano* and *Battaglia* are stations on the line from Padua to Bologna.]

D. HUNGARIAN SULPHUR-THERMÆ.

The Hungarian sulphur-thermæ are little visited by foreigners, but they are of great importance in comparative balneotherapy, in so far as for the most part very warm baths, even up to 44° Cent. (111·2° Fahr.) are taken; and, accordingly, clinical experience has assigned to them the indications adapted to vigorous thermal

treatment, the effect of which might readily be ascribed to sulphuretted hydrogen, if in the immediate influence of each separate bath the pathognomonical symptoms of the effect of sulphuretted hydrogen were observed. The alleged amount of sulphuretted hydrogen is so enormous in some of these baths, that one might expect, indeed, the symptoms of sulphur-poisoning; the analyses, however, deserve no confidence and require revision.

Mehadia (Hercules baths), in the Banat, near Orsova, Mehadia.
in a beautiful and magnificent valley of the Carpathians, the mild and equable climate of which manifests itself in almost southern vegetation, is one of the most frequented spas of Hungary. The springs, from 30° to 55° Cent. (86° to 131° Fahr.) in temperature, are similar to those of Aix-la-Chapelle; i.e., they contain, besides sulphuretted hydrogen, a considerable quantity of chlorine-combinations, some in about the same extent as Aix-la-Chapelle, and others in double. The usual indications are the same as at Aix-la-Chapelle, with this difference, that at Mehadia the effect is extolled as wonderful. The severest cases of rheumatic, gouty, and traumatic exudations and derangements of nutrition are said to have been cured there. We refer to the section of the first book on the thermal system, to point out the delusions which must arise from such vague assertions: the cases adapted to the thermal system we find in the list of the different baths all the more strongly emphasised, and the successful results in rheumatic and gouty joint-exudations are all the more frequent, or, more correctly stated, are all the less rare, the more energetic the treatment used at the bathing resorts. At Aix-la-Chapelle the obstinacy of these exudations led to the frequent use of vapour baths, and at Mehadia *piscine baths are used up to 41° Cent. (105·8° Fahr.) of heat!* This vigorous thermal treatment produces, of course, in many cases where no complicated condition prohibits such warm baths, considerable results, attainable sometimes with any water at an equally high temperature; the rarity, however, of these results in no wise justifies such general, rash, and confusing assertions. In cases also of scrofulous exudations, Mehadia is famous,

and in these also it is the vigorous *treatment* which produces the result. (Drs. Chorin, Klein, and Munk.)

Pystjan.

Pystjan (Posteny), in Upper Hungary, is a similar instance, like Mehadia, of vigorous thermal treatment. The spring contains 10 grains of fixed component parts, among them 4 grains of sulphate of lime and $2\frac{1}{2}$ grains of Glauber's salt, besides 0.47 cubic inches of sulphuretted hydrogen, therefore less than Mehadia; the ordinary temperature of the baths, however, especially of the favourite mud piscine baths, amounts to 44° Cent. (111.2° Fahr.), and is therefore still higher than at Mehadia.

Teplitz.

Teplitz-Trencsin has similar springs to Pystjan, but the treatment is not so vigorous, and, accordingly, the reputation of the spa is not so great.

Töplitz.

Harhany, Grosswardein, and Töplitz-Warasdin possess for the present a special interest, owing to the great amount of sulphuretted hydrogen, 4–6½ cubic inches, which it is asserted that they contain; the analyses, however, require revision.

[We have mentioned the *Algerian hot sulphur-baths* under the head of indifferent thermal waters. Quite lately Dr. Reil, of Cairo, has directed attention to the warm sulphur springs of *Hélonau*, or *Helwan*, situated about four hours south of *Cairo*, near the station of Bedrenlien. Their temperature is slightly below 90° Fahr. and they contain in 1,000 parts 6 solids, which consist principally of chloride of sodium 3.2, chloride of magnesium 1.8, and of 0.044 sulphuretted hydrogen. Good arrangements seem to be in progress, under the patronage of the Viceroy. Hélonau contains also *warm saline springs* with 11.4 solids in 1,000 parts, including sulphate of soda and magnesia.]

CHAPTER V.

MOOR OR MUD-BATHS.

INDUSTRIOUSLY as chemical analysis has investigated numerous and different moors, and justly and commonly famous as are the moor and mud-baths of various spas, still the explanation of their effect is obscure, and the indications of the cases adapted to them are not yet fully confirmed.

The result of unbiassed clinical experience, as regards the numerous and strongly emphasised cases indicated in the literature on the subject, may be expressed in two statements: 1, in most cases moor-baths produce an effect like that of warm baths, on account of their moist heat; and, 2, the few cases in which from experience preference is given to moor-baths above other forms of thermal treatment, furnish no pathological and chemical basis of explanation for a theory; but, in fact, partly contradict those explanations which the chemical constitution of the remedy almost naturally yields.

Result of
clinical ex-
perience.

These cases are:—1. *Rheumatic and gouty exudations* in delicate individuals, in whom the vigorous thermal treatment demanded by local conditions is forbidden by the individual capability of the organism. Moor-baths of 35 to 37° Cent. (95 to 98·6° Fahr.) do not in general prove so stimulating by far as water-baths of the same temperature. We must here remark that, in cases of *muscular rheumatism*, moor-baths do not rank so highly.

Exuda-
tions.

2. *Hyperæsthesia combined with paralytic affections*, especially hysterical spinal irritation and tabes dolorosa. A few reliable experiences furnish some cases in which moor-baths have fulfilled the indications adapted to the thermal system, without causing that over-excitement

Paralysis
combined
with spinal
irritation.

which would have accompanied the application of other forms of baths in the same cases, and would have hindered their good effect; we have not, however, succeeded in deducing a single rule, even of a clinical character, from these observations or from the statements in works on the subject, and empirical trial is at present all the practical maxim established.

Paralysis
with active
contrac-
tion.

3. *Paralysis combined with Contractions.*—Cases of this class illustrate most plainly the peculiar effect of moor-baths. Our experience refers to a series of cases of paralytic contractions observed thoroughly and for a long period, and proceeding from myelitis, caries of the vertebræ, syphilitic exostoses of the vertebræ, meningitis basilaris after small-pox and scarlet fever. The most important pathognomonical symptom was active contraction, the active character of which especially shewed itself in the fact that on attempting to use the limbs the contraction immediately increased, and often amounted to clonic convulsions. For the most part the sphincter muscles were affected, or they were so, at least, at the commencement of the disease. A few instances will illustrate the condition. A young man was suffering from this paralysis in consequence of scarlet fever. When seated or lying down he had the free use of his legs, but as soon as he rose and attempted to walk, the adductor muscles contracted, the knees knocked together and were not to be separated, and the walking was only managed by means of pushing the hips forward alternately to the right and left. Another person was suffering from a similiar paralysis in consequence of syphilitic affection of the vertebræ; the flexor muscles of the leg and the ilio-psoas were, however, constantly contracted, and this contraction, on the slightest attempt at walking, extended to the adductor muscles and produced clonic convulsions in them. In such cases we have never seen any successful results attending the use of the thermal treatment usually prescribed for paralytic patients, but, on the contrary, an aggravation of the symptoms. Many cases have remained also unimproved by moor-baths, but whenever we have perceived an improvement, it has been obtained solely by the

use of moor-baths; the symptoms of irritation have become diminished, the contractions and clonic convulsions have subsided, and in some cases, it is true, only after repeated trials, the result has been so considerable that the sick person, though with difficulty, has been enabled to walk.

From these experiences, the clinical character of the effect of moor-baths appears to be *that in many cases, when from individual causes the thermal system cannot be borne on account of its too stimulating action, the effect of this system is produced by moor-baths without causing this over-excitement.*

If, however, we investigate the physical and chemical properties of this remedy, forming as it does such a distinct clinical speciality, we do not obtain the slightest support for any rational theory, and even possible hypotheses contradict other well-grounded experiences and present contradictions to each other.

The *moor-baths* are prepared by means of saturating the moor-earth frequently for years with simple or mineral water, and by afterwards mixing the moor thus prepared with warm water, so that the bath fluid forms a pultaceous mass of from 1.2 to 1.3 of specific weight. The amount of solids contained in the moor varies according to the place from which the moor-earth is taken, and its shorter or longer preparation, which is accompanied in the upper strata by processes of oxidation, and according to the amount of salt in the water applied to the preparation. Hence the different analyses of the same kind of moor differ greatly from each other, and such an analysis possesses no absolute, but only relative value.

Physical
and
chemical
properties
of moor-
baths.

The component parts of the most importance quantitatively are: vegetable substances and remains of plants, humus and humic acid, resin, silica, alumina, phosphate of oxide of iron, sulphuret of iron, chloride of sodium, sulphates, especially of lime and of protoxide of iron, and sulphuric acid.

The organic substances which are to be conceived in constant formation and transformation, especially formic acid, are not yet sufficiently examined. With which of these component parts is the effect of the moor-baths

connected? The substances to be taken into consideration in this respect are the following.

Gases in
the moor.

1. The *gaseous substances*, carbonic acid and sulphuretted hydrogen, are not fixed in their quantitative proportions, and we find nowhere in any description of the direct effect of a moor-bath the characteristic symptoms of the effect of *these gases*; and we have still further to take into consideration that, from the numerous conditions favouring complicated chemical changes, the formation of these gases is probably very different at different times in the same moor.

Organic
substances.

2. The *organic substances*, the humin and resin, are indifferent substances which are not known to produce any effect on the skin. It is true, many resins produce a slightly irritating effect, but these do not seem to be represented in the moor, as after the moor-bath there is no erythema to be observed, but only, as after water-baths, a slight congestion of the skin.

Formic
acid.

The case is similar with the *formic acid* and other *volatile acids*. As regards the formic acid, it has hitherto been only occasionally found in the moor, and this first by G. Lehmann in the Marienbad moor, and by Gorup-Besanez in the moor of Wiesau (Palatinate), in the former at the proportion of 0.4 per cent.; it is, however, probable that it is to be found in all moors, although only at times, as it is one of the most frequent products of the transformation of nitrogenous and non-nitrogenous matters in combination with oxidising substances. The inflammatory and epispastic effect of pure formic acid and the irritating effect of *spiritus formicarum* is known well enough; but whether an amount of 0.4 per cent. can exercise any perceptible influence, is not ascertained, and is in nowise expressed by the condition of the skin after a moor-bath. We know nothing further of the effect of other volatile acids and of the acids of black mould, but that they are uninjurious when taken internally with the waters, and we may conclude from this that they would produce no effect if applied outwardly to the skin.

Mineral
substances

3. The *insoluble minerals*, silica, argillaceous earth, lime, oxide of iron, phosphate of oxide of iron, and sul-

phuret of iron, are also indifferent in their effect when placed in contact with the skin, as are also the *soluble mineral* salts, such as sulphate of potash, soda, magnesia, lime, and protoxide of iron; neither in baths, nor in pharmacodynamic experiments has any effect been proved to be produced by these substances on the uninjured skin. The denominations of 'saline moor,' 'iron moor,' and 'styptic moor' are of no clinical importance.

4. The *greater density of the moor-bath* has a share, Density. perhaps, in its effect; yet just as little is known on this point as on the influence of the density of simple water.

5. The *temperature of the moor-bath* is distinguished Tempera-
ture. from that of the water-bath by its *want of uniformity*, which partly arises from the impossibility of any equable mixture of the warm water and vapour with the moor, and partly from the constant chemical transformations going on in the moor, differing according to the different strata. This circumstance affords perhaps the most admissible foundation for an hypothesis, namely, that the non-uniform temperature of the moor, varying perhaps a degree or the fraction of a degree, acting on innumerable parts of the skin and in rapid succession, modifies its effect and moderates the direct influence of the higher bath temperatures.

As regards the moor-baths, therefore, there is an entire lack of any theory with reference to the effect produced, and for the present we must rest satisfied with the clinical facts which establish the same classes of diseases as adapted to this remedy as those suited to the thermal system, with the difference that the moor-baths do not over-excite so easily as other very warm baths. For this reason, they are by many strongly advocated for chronic tumours in the spleen; but they do not do more or less Spleen
tumours. than other forms of thermal treatment in stimulating absorption and the formation of blood; i.e., they shorten the course of treatment and assist other remedies, such as alkaline and saline mineral waters, iron, and above all, quinine and bark.¹

Local applications of moor to the head, the epigastric

¹ See Bamberger, *Unterleibskrankheiten*, p. 670.

region, and other parts are also considered of great value by the advocates of moor-baths, though no proof is brought forward that they are anything but warm poultices.

Mud-
baths.

Moor-baths are to be found at the following well-known spas, namely, *Marienbad*, *Franzensbad*, *Teplitz*, *Eilsen*, *Nenndorf*, *Elster*, *Driburg*, *Meinberg*, and others. Besides moor-baths, *mud-baths* are used at many places, especially at the Hungarian spas of *Pystjan* and *Teplitz-Trencsin*, at the *Euganean thermæ*, and, as a particular speciality, at *St. Amand-les-Eaux*, in the department Nord, not far from Valenciennes. They are prepared with the mud deposited by the springs, which consists of silica, carbonate of lime, sulphuret of iron, and argillaceous earth, besides other slight organic combinations, and which occasionally contains also large quantities of sulphur; nothing else, however, is stated as to this effect than what experience teaches of the so-called 'saline' and 'styptic' moors. In Sweden and in the Russian Baltic provinces, baths with *sea-mud* are held in great repute, and these, from their large amount of common salt, may be regarded as strong sool-baths.

Sea-mud.

CHAPTER VI.

ALKALINE AND CHALYBEATE SPRINGS AS BATHS. PINEWOOD-BATHS.

1. *Alkaline springs* are predominantly used for drinking, and they rank as waters for drinking in the system of balneotherapeutics. The older spas, the first use of which dates at a period when courses of drinking were not yet in use, were certainly at first only used as baths, and the names of these spas terminate therefore rarely in 'Brunnen' ('spring' or 'well'), but generally in 'Bad' (bath). Carlsbad was for centuries only used for baths, and even subsequently, when the waters were drunk there, the bath was a part of the treatment, until in the last century it fell more into disuse until recently, when it is again more recommended. In most places where alkaline waters are drunk, bath arrangements exist and baths are used; in some much-frequented spas, such as Marienbad, Franzensbad, Elster, moor-baths especially predominate, but in most the baths are prepared from the waters of the drinking springs; only in a few can this be done direct from the springs to the baths, owing from the want of a natural temperature suitable for bathing; most of them are either cold or very warm, and require to be cooled by standing in the reservoirs, or to be artificially heated.

Alkaline
baths.

The component parts which are taken into consideration in alkaline waters when used for baths, are *carbonate of soda* and *carbonic acid*; the amount of sulphates and of lime-salts has no effect in the bath, and the amount of chloride of sodium contained in some, and which are therefore called alkaline-muriatic springs, is too small, in most only 8 grains to 16 ounces, to produce any effect upon the skin; and even the spring of Luhatschowitz, the

strongest in this respect, contains only 33 grains, and therefore not quite $\frac{1}{2}$ per cent. The amount of common salt in these waters is accordingly only negatively to be taken into consideration as a counter-indication, inasmuch as Hebra's warning, which has been already often mentioned, may be applied to it, namely, that in most cases of chronic eczema even a small amount of common salt in the bath acts as an injurious irritant.

Carbonate
of soda.

Carbonate of soda in the bath-water produces either a softening or a stimulating effect upon the skin, according to the strength of the solution, the latter being a slight degree of the caustic effect of alkaline hydrates. The *softening effect* consists in the chemical solution of the secretions of the skin and the scales of the epidermis, and thus also in a moistening of the outer layer of skin; it is caused already by a very weak amount of soda, a few grains in 16 ounces render the water soft and softening, and a stronger amount of between 6 and 20 grains, as in most cases, and even, as in a few, of 44 grains, continues to produce a softening, not an irritating, effect. The carbonate of soda adds, therefore, nothing more to the effect of the warm water in the bath than to give softness and a softening power to the water, and thus alkaline baths are only to be considered as indifferent thermæ as regards the amount of soda they contain, presupposing that the amount of carbonic acid is not important enough to develop the peculiar effect of this gas.

Carbonic
acid.

Carbonic acid is represented as a constant component part in all alkaline springs; it is strongest in the cold springs, and it is also tolerably strong in a few warm ones, such as *Ems*, *Vichy*, and *Neuenahr*. Both in the artificial heating of the water, and in its artificial cooling by prolonged standing, a part of this gas escapes. The amount of gas contained in the baths is therefore different from the amount appearing in the analysis of the springs. The manner of preparing the baths is of great influence, and with varying bath-arrangements the amount of carbonic acid, even at the same place, must vary. Hence it is not to be wondered at that, in many alkaline baths, the characteristic effect of the carbonic acid, namely,

a strong feeling of heat in a cooler temperature of bath, is not observed; and that in others, when it is observed, the statements contradict each other; and this all the more, as the injurious inhalation of the gas escaping into the air is to be taken into account, and this may be very strong, though only a small remnant of carbonic acid is found in the bath-water itself. Arrangements have recently been universally made, wherever cold soda and chalybeate springs require to be heated, to prevent as far as possible the escape of the carbonic acid; most of these are modifications of the Schwarz system, which consists of a double bottom to the tub, fitted with copper or leaden steam-pipes.

It is therefore requisite, in order to settle the importance of the carbonic acid in the different alkaline baths, that at the respective spas the amount of gas in the bath-water in the tub should be ascertained and regulated, and investigations made as to the above-mentioned characteristic effect of the carbonic acid in the bath, namely, the sense of heat in a cool temperature. Not till these arrangements and investigations have yielded tolerably constant results, can the comparison with the primary effect of thermal soot-baths be instituted, and the question solved as to whether and how far the amount of chloride in the latter produces or modifies the effect of the carbonic acid. The springs which belong to the class just mentioned, are throughout springs used for drinking, and their baths may be regarded as indifferent thermæ, containing a various amount of carbonic acid, quantitatively not ascertained and regulated, and problematic in its effect. The warm springs are Vichy, Neuenahr, Ems, Carlsbad, Buda, Mont-d'Ore, and Royat; the cold are Gleichenberg, Salzbrunn, Luhatschowitz, Marienbad, Franzensbad, Elster, Cudowa, Reinerz, Rippoldsau, Petersthal, Antogast, Flinsberg, Altwasser, Vals, and others.

2. *Steel-baths*, i.e., baths which are prepared with the chalybeate springs used for drinking, are considered by the science of the present day, which knows nothing of the absorption of iron in the bath, no longer as iron-baths, but as indifferent baths with a varying, not yet sufficiently

Postulate
for future
investiga-
tions.

Steel-
baths.

ascertained, amount of carbonic acid. The quantity of carbonic acid in most of these springs is considerable, often more considerable than that in alkaline springs; all are cold and require to be heated, and where, as at Schwalbach, this heating is done with great precaution, a sufficient amount of gas is left in the bath-water to develop the specific effect of the carbonic acid. The well-known effect, however, of the gaseous bath in improving nutrition and sanguification must not lead us to the conclusion that the increased amount of iron in the blood is derived from the bath; all bath-treatment which accelerates the change of substance places the organism in a position to obtain the deficient iron from that source which furnishes it to every healthy person, namely, from food. If, in spite of this, the name of *steel-baths* is still maintained in the special literature relating to the subject, it is a matter of regret, and this all the more if, as still often happens, the question of the absorption of iron in the bath is passed over, or even, in the face of contradictory and universal experience, it is asserted as a fact. Thus it is erroneous when the effect of baths prepared from the Selkebrunnen (Selke spring) at Alexisbad, are called astringent, and are used as such, on the ground of the amount of sulphate of protoxide of iron and chloride of iron they contain. This spring contains no carbonic acid, but only $3\frac{1}{2}$ grains of fixed component parts, and among these $1\frac{1}{2}$ grains of iron, and this, according to Tromsdorf, combined in smaller proportions with sulphuric, and in greater with muriatic acid. According to Schauer, the local physician, the iron is entirely combined with the latter, and therefore forms chloride of iron. The simple dose of both these iron salts for internal use amounts from 1 to 4 grains; the strength of the solution for external application, on account of the astringent effect on the mucous membranes and ulcers, is from 2 to 10 grains to *one* ounce of water. Experience and clinical observation know nothing at all of any astringent effect produced by a solution of this kind on the uninjured skin; but supposing we allow or assume this, in spite of the more than problematical absorption by the skin, we are in such a case expected to believe that

water containing $1\frac{1}{4}$ grains of chloride of iron or sulphate of iron in 16 ounces, or $\frac{5}{8}$ of a grain in one ounce, produces the same astringent effect upon the uninjured skin, and thence upon the internal organs, as that produced by solutions of from 2 to 10 grains in 1 ounce upon diseased membranes and ulcers. Alexisbad possesses, in addition to this bath-spring, an excellent drinking spring containing a medium amount of carbonate of protoxide of iron and a moderate amount of carbonic acid; it has also a fresh mountain climate which has a tonic effect, even apart from the usual course of water-drinking. The author has himself found strength and rapid recovery there after severe illness and anæmia, simply adhering to milk-diet and not taking any baths or waters. So long as the belief was current that the iron in the bath was absorbed, baths were frequently used containing ferrum sulphuricum and globuli martiales; since this belief has been shaken, the use of these artificial iron-baths has greatly subsided; but the time has now arrived for the natural steel-baths to be regarded and used for what they are, namely, *partly as indifferent baths* and *partly as baths containing carbonic acid*. And here again it is necessary to make arrangements for easily regulating the amount of carbonic acid, and thus to facilitate exact observations regarding its effect.

PINE-LEAF BATHS.

Pine-leaf baths, like so many other remedies which assume the position of universal methods, have not by any means fulfilled the promises of enthusiasts, though they continue to form an efficacious and agreeable kind of bath of the thermal order, especially in those cases where it is desired to powerfully excite the skin, without producing this excitement by any great warmth of bath. It is especially chronic muscular rheumatism without any considerable exudations which form the most promising cases for these baths. They are, however, adapted to all the cases suited for thermal treatment, and especially such cases as require fresh forest-air and quiet life, since most of the spas for these baths are situated in quiet secluded

towns and villages in a somewhat mountainous position, surrounded with rich vegetation.

The bath-fluid is usually composed of two parts, namely, a steam distillation which contains the ethereal oil of the pine-leaves, and a decoction of pine-leaves, chiefly consisting of resin and organic acids, especially formic acid. This decoction is also thickened into the consistency of an extract, for transmission abroad.

From 2 to 20 quarts of the decoction are added to the bath, according to its different strength, and this kind of preparation seems to give a much stronger bath than the use of smaller corresponding quantities of the extract.

To other baths also, especially to sool-baths, the decoction or extract is added, not only in order to strengthen the stimulating effect upon the skin, but also in order to make the bath agreeable from the balmy and refreshing perfume. Moreover, it is not to be denied that the resinous evaporation from the bath has the same quieting and tonic effect upon the irritated bronchial membrane as is produced by the balmy air of pine-forests.

Establishments for pine-wood baths are combined in many places with older and longer existing remedial resources; with cold-water establishments at Alexandersbad, Schleusingen, Tharand, Ruhla, Ihmenau, and Nassau; with sool and other baths at Arnstadt, Liebenstein, Rippoldsau, Salzungen, Schmalkalden, Hofgeismar, and Sulza. There are other establishments at Blankenburg, Eisenach, and Friedrichsrode, in Thuringia; at Ilsenburg, and Andreasberg in the Harz mountains; and at other places.

BOOK III.

DRINKING-COURSES OF MEDICINAL WATERS.

ALTHOUGH, in the use of medicinal waters, substances are in question which either produce an immediate effect upon the mucous membrane of the stomach and intestines, or which pass into the blood, and the special effect of which has long been a subject of pharmacodynamic investigation, yet this branch of balneotherapy is marked in nowise by greater precision, nor by a greater number of clearly known facts than the subject of baths, which was treated upon in the second book. The reasons for this deficiency evidently lie in all the circumstances concerned. In the first place, we possess only a very limited number of accurately proved facts regarding the pharmacodynamics of gases and salts; in the second place, the different mineral waters, by different combinations of the respective substances, form a great number of compound remedies, similar to each other in some of their component parts, and differing in others; added to this, in the third place, there is the difficulty of determining the influence of the respective substances and their solutions upon the stomach and intestines, and especially upon the change of substance; and, lastly, from different, though correct and careful clinical observations, there is no general conclusion to be drawn, affording any ground for analogies, because the individual diseased organism turns the remedy to account in its own individual and often unknown manner.

Uncertainty of the treatment.

In spite of the countless different combinations, there are still but a limited number of substances which appear in these combinations; these are *carbonic acid*, *sulphu-*

retted hydrogen, sulphuret of sodium, nitrogen, carbonate of soda, sulphate of soda and sulphate of magnesia, chloride of sodium, carbonate and sulphate of protoxide of iron, carbonate of lime, iodine, and bromine. A truly established system of pharmacodynamics ought (1) to prove the peculiar effect belonging to each of these substances, and this both on the mucous membrane of the stomach and intestines, as well as on the blood, the tissues, the secretions, and the change of substance; it ought (2), with regard to those substances which produce similar effects, which, for example, effect the increase of the secretion in the bowels, to prove in what this similar influence consists, and by what it is especially distinguished in the different remedies; lastly, it ought (3) to compare the clinical experiences respecting the empirical effect of different mineral waters in similar and different cases of illness with the physiological effects mentioned under the points 1 and 2, and to explain them from these.

We find, it is true, in many compendiums an abundance of precise indications, based on the different chemical constitution of the waters, which might inspire the belief in those not initiated in practice, that this branch of balneotherapy had actually obtained that degree of ideal perfection which it would have reached could it fulfil the requirements just stated. The contrary is, however, true: in no branch of pharmacodynamics does so much uncertainty, indistinctness, and contradiction prevail as in this. Even the effect of the narcotic alkaloids, which have only recently been known, is established with greater certainty than that of the salts long known as contained in mineral waters; and even the substances which afford the comparatively clearest and simplest clinical explanation of their therapeutic effect, such as iron and iodine, are still far removed from being perfectly known as to their physiological effect.

As in other perplexities of practical medical science, here also theoretic opinions have been adhered to with predilection, and have been introduced into practical maxims; which are partially only hypotheses, partially refuted by facts, and partially in contradiction to

other facts. The Liebig theory, according to which the aperient effect of the sulphates proceeds from exosmotic adjustment, is still adhered to by many in balneotherapy, although it is shaken, if not refuted, by contradictory experiments. The theory of the effect of the use of lime in rickets, although in no wise proceeding from sober practice, is readily made use of in establishing indications for the use of those waters which contain calcareous salts in addition to other salts. The effect of common salt in cases of scrofula meets only *one side* of this disease, and fulfils only one requirement, namely, the dilution and lixiviation of the blood, to induce rapid absorption of threatening exudation; nevertheless, waters containing common salt are frequently regarded as an *universal* panacea against scrofulous diseases generally, and in the most different cases there is for this reason a preference for those waters in other classes of springs which contain a degree of common salt in addition to their characteristic component parts, in all conditions of illness resulting from scrofulous complications. In this way we find in balneotherapy a number of special and chemically established statements, which are nothing more than unpractical abstractions and designed makeshifts, and which have greatly tended to obscure this branch of medicine. Whilst, in our accurate age, no new fact can arise within the range of the exact sciences such as physiology, chemistry, and pathological anatomy, without at once meeting with confirmation or refutation on the part of independent investigation, as regards balneotherapy no such critical investigation exists; everything is asserted, because everything is believed, or at any rate the refutation is not considered worth while, and criticism is for the most part in the hands of a coterie.

CHAPTER I.

CARBONIC ACID IN MINERAL WATERS.

THE few lines in which, when speaking of the baths containing carbonic acid (page 233), we mentioned the effect of carbonic acid when taken inwardly, exhaust, in spite of their brevity, almost all that we know on the subject, and all that it is important to take into consideration with regard to mineral waters.

Primary
effect.

Carbonic acid acts, in the first place, as a stimulant to the mucous membrane of the stomach and intestines, and excites their peristaltic action; this is the only thing which we know *indubitably* of the local effect, and which, moreover, is confirmed and explained by the experiment of placing the bare muscular fibres in contact with carbonic acid. The other usual statements as to the stimulation of the *secretions of the stomach*, and as to the *quieting of the sensitive nerves of the stomach*, though they are sufficiently confirmed, rests, as regards their interpretation, upon conjecture; both effects may be caused by the direct stimulation of the carbonic acid, but they may also be *indirectly* produced by the increased peristaltic action. The facilitation of digestion and absorption through carbonic acid, is explicable in the same manner. The carbonic acid itself, when it is introduced in smaller quantities, is in no wise rapidly absorbed, but for the greater part it is either quickly removed by eructation, or it is carried with the water into the intestines, and thence ejected. Introduced in larger quantities, it excites, it is true, the movements of the stomach, and retching to a still greater degree, but part of it also remains long enough in the stomach for its partial absorption, and in this case there distinctly arise symptoms of its effect on the blood—a

slight feeling of intoxication, excitation of the sensorium, and acceleration of the respiration and of the beating of the heart; this effect is a passing one, because the carbonic acid is very rapidly ejected from the lungs and skin. Lastly, if a great accumulation of the gas occur in the stomach, this general effect increases till the blood is poisoned, the appearances become more intense and permanent, and death from asphyxia becomes imminent. This extreme degree of effect seems, however, to be restricted to the powerful diffusion of the gas from *fermenting liquors*, and we find no case mentioned in the works on the subject, in which any immense amount of *water* containing carbonic acid had caused death in a similar way to fermenting young wine. It is true that, after a large amount of gaseous waters, unpleasant and even threatening symptoms frequently appear, especially in individuals inclined to hyperæmia of the brain and lungs, and with organic heart-disease; but in these cases we have to deal with individual conditions, and with the inclination of the stomach to retain or eject the gas, which inclination differs according to the person, the time of the day, and other circumstances. Hence no limit can in any wise be stated as to what amount of gas is bearable or injurious; but we can only generally say: 1. That a greater amount of carbonic acid is endurable in cold waters than in warm waters, because the effect of heat increases that of the gas; 2. That the agreeable local effect on the stomach and intestines appears even with a small amount of a few cubic inches to 16 ounces of water; and that a larger amount, as much as 30 or more cubic inches, is, as a rule, essentially diminished by the abundant ejection that at once occurs. Hence the experience is of great practical importance that the profuseness of the eructation stands in inverse proportion to the quantity of the water. Small quantities of water facilitate the retching, and large quantities impede it; hence the weaker acidulated or gaseous springs are better borne in large quantities than the stronger. This fact is so far of importance as regards very many mineral waters with a strong amount of carbonic acid, especially many steel waters, that the quantity in which they may be

taken with benefit is regulated by their amount of gas. It is not the alkali, nor the iron which they contain, that renders these waters for the moment exciting and difficult to be borne, but the excessive amount of gas; and this can be very easily diminished by shaking them or allowing them to stand, because the effect of carbonic acid in promoting digestion for the most part occurs at an amount of from 6 to 10 cubic inches, while these waters occasionally contain more than 30 cubic inches. In the same way as water devoid of gas may be supplied with carbonic acid, richly gaseous waters may be deprived of their excess.

Lastly, carbonic acid, taken inwardly, seems to exercise an effect on the secretion of urine.

The effect of carbonic acid in mineral waters is accordingly:—1. The quieting of the sensitive nerves of the stomach; 2. The stimulation of the secretions and the peristaltic action of the stomach; 3. The stimulation of the action of the bowels; 4. Increased secretion of the kidneys. In addition to these, we may allude to the importance which free carbonic acid possesses in the solution, and in the holding in solution of the bicarbonates contained in mineral waters, especially the bicarbonates of soda and iron.

INDICATIONS FOR THE USE OF CARBONIC ACID.

Atony of
the
stomach
and
intestines.

The most important case is that of *sluggishness of the action of the stomach and bowels*, which every one occasionally experiences as a passing condition, and which in many is a permanent malady, owing either to early disposition or to special habits of life. The effect of the effervescent soda powder ('pulvis aerophorus'—'Brausepulver') on acute indigestion and inclination to sickness is well known; but at the same time it is often overlooked that this effect presupposes the previous emptiness of the stomach, and, from the neglect of this, the effervescent powder very often aggravates the condition.

The torpidity of the muscles of the stomach and intestines, sufficiently important to be regarded as an

illness of itself, or at any rate as one requiring treatment, appears especially in two classes of constitutions: 1. In men suffering from hypochondriasis or allied conditions; and 2. In a great number of young girls and women, in whom a sluggishness of the muscles of the intestines has been left behind from a scrofulous tendency in childhood, causing habitual constipation, frequently from three to six days. To counteract this constipation, all the remedies are in course of time tried, which in any way are considered to promote defæcation. Many such sick persons find at length some palliative, in the constant use of which the function is kept feebly going, but rarely a remedy which attains the object without injurious effects, and still more rarely one that attains it radically. The most moderate of these remedies are the vegetable drastics, presupposing that small doses are sufficient; the most injurious are aperient salts, and the mineral waters which contain them. These produce fluid secretions, and by this means a direct increase of the action of the bowels; but they do this only momentarily, and injure the intestinal mucous membrane and lower the sanguification. It is true that these waters have an undisputed result in cases of passive congestion of the abdominal organs, corpulence, and liver-disease; but in these they only meet the causal indication as regards constipation. In cases of pure weakness of the intestinal muscles, especially in the sluggishness of women just mentioned, the author has never seen any removal of the constipation from the use of salts, but only a palliation of it. On the other hand we, and a number of active practitioners also, have found on many occasions the use of *carbonic acid* in these cases as an actual radical remedy, and this after immense quantities of aperient waters have proved ineffective. In cases where the constitutional constipation of women has required doses of from one to two pints of some saline water, in order at length to relieve the bowels by violent diarrhoea, one glass of artificial Selters water, taken fasting, is often sufficient to effect a normal evacuation. Very frequently, by this daily stimulation of the intestinal muscles, their sluggishness is entirely and permanently

removed; and when this is not the case, a gaseous spring, at any rate, affords a remedy which has not, like saline waters, the nature of a drug, but only that of a dietetic measure. Carbonic acid seems, in cases of simple sluggishness of the action of the bowels, to be the most adequate remedy, and it produces an effect without directly increasing the secretion, i.e., without causing diarrhœa. In many very obstinate cases, however, the object is only obtained by gymnastic exercise and total change of diet; in others, where the torpidity is in the rectum, it is effected by cold hip-baths and cold injections.

Nervous
conditions.

2. From its adaptability with regard to dyspepsia and sluggishness of the bowels, there follow a number of other indications for the use of carbonic acid in other conditions of this kind, especially of a *nervous character*, which wholly or partially proceed from these disordered functions of the stomach and intestines; and these we feel it all the less necessary to enumerate, as the application of the remedy has for the most part only a dietetic importance.

Catarrh of
the
respiratory
mucous
membrane.

3. The current indication for the use of waters containing carbonic acid in cases of *catarrh of the respiratory membrane*, seems based upon an error, and to arise from the confounding of carbonic acid with the effect of the carbonate of soda contained in several acidulated springs. Carbonic acid is intended to render the tenacious secretion fluid, and thus to act as an expectorant. The primary effect of the remedy does not explain this theory; certainly, however, plentiful drinking acts as an expectorant, and in many cases directly stimulates the intestinal function.

AMOUNT OF CARBONIC ACID IN MINERAL WATERS.

Digestible
ness of
mineral
waters,
owing to
carbonic
acid.

From its beneficially stimulating effect on the action of the stomach and bowels, *carbonic acid is an important means for the digestion of many mineral waters*; and the greater the amount of salts in the latter, the more they require some carbonic acid in order to be absorbed and digested; whether, however, even in waters containing salt, a greater amount than about 6 to 10 cubic inches to 16 ounces, or

32 cubic inches, of water is required, is much to be doubted; it is, on the contrary, highly probable that, where a greater amount of carbonic acid troubles the stomach or injures the blood, the gas, without detracting from its effect, may be reduced to the smaller quantity.

Waters which contain, in addition to carbonic acid, only a few grains of salts, especially of carbonate of soda, and therefore not more than spring-waters, are called *simple acidulated or gaseous springs*. There are very many of these which are scarcely known beyond the locality of the spring, and which are rarely accurately investigated with regard to their amount of gas. Most are, however, saturated with carbonic acid, i.e., they contain as much as the water can altogether receive, according to the depth of the spring and the atmospheric pressure; this proportion amounts to about a volume of carbonic acid to a volume of cold water, with simple atmospheric pressure. If the pressure be multiplied, the carbonic acid is in proportion; in that case so much escapes from the surface of the spring, that at length the amount of the simple volume is restored. Where such simple acidulated springs do not exist, artificial manufactures are made use of, possessing a varying amount of salts and gas under the names of artificial acidulated water, Selters water, and soda water. The acidulated alkaline waters also, which possess a considerable amount of carbonate of soda, and the alkaline muriatic acidulated waters, in which common salt appears, and the weaker but chiefly gaseous chalybeate springs, are all used in their own localities very frequently as carbonic acid drinks. Recently, H. E. Richter has drawn attention to distilled water impregnated with carbonic acid, as a menstruum for medicinal substances. The amount of carbonic acid in the mineral waters most employed is shewn in the following figures: we must, however, observe that many of these statements are in no wise to be relied on, as they proceed either from old or not very authentic analyses:—

Alkaline acidulated springs (cubic inches to 16 ounces of water): Vichy, 12 to 13; Neuenahr, 17 to 38; Geilnau, 23; Preblau, 29; Fachingen, 33; Bilin, 33; the Fellathal springs, 38; [Apollinaris, 47].

Simple
acidulated
springs.

Artificial
acidulated
waters.

Amount of
carbonic
acid in
mineral
waters.

Alkalinemuriatic acidulated springs: Ems, 12 to 20; Roisdorf, 19; Luhatschowitz, 14 to 50; Gleichenberg, 22 to 35; Salzbrunn, 37; Selters, 30.

Alkaline saline springs (containing sulphate of soda): Stubnya, 3; Ofen, 3 to 6; Bertrich, 4; Carlsbad, 8 to 17; Marienbad, 9 to 22; Rohitsch, 25; Füred, 38.

Alkaline chalybeate acidulated springs (sulphate of soda, carbonate of soda, chloride of sodium, and carbonate of protoxide of iron): Elster, 16 to 28; Liebwerta, 21; Altwasser, 26 to 41; Franzensbad, 26 to 40; Borsék, 28; Reinerz, 28; Flinsberg, 27; Rippoldsau, 32; Petersthal and Nieder-Langenau, 33; Cudowa, 35; Bartfeld, 45, Schwalheim, 49.

Pure steel waters: Muskau, 0; Vichnye, 6; Alexisbad, 8; Meinberg, 5 to 37; Spa, 20; Pyrmont, 26; Driburg and Steben, 29; Brückenau and Imnau, 30; Schwalbach, 38; Bocklet, 39; [St. Moritz, 31 to 57].

Common salt springs: The simple sool-springs, and Kreuznach, 0; Baden, 1.5; Mondorf, 1; Hall iodine water, 2; Schmalkalden and Dürkheim, 4; Wiesbaden, 6; Mergentheim, 9; Nauheim, 12; Adelheidsquelle, 13; Rehme, 18; Zaizon, 16 to 30; Pyrmont salt spring, 26; Cannstatt, 19 to 27; Soden, 14 to 48; Iwonicz, 30; Crons-
thal, 33 to 40; Kissingen, 41 to 48; Homburg, 43 to 55.

Earthy springs: Wildungen, 36; Lippspringe, 4; Weissenburg, 2; Leuk, 0.

Of the *bitter waters*, only Püllna and Friedrichshall contain respectively 2 and 9; both the artificial and natural bitter waters are often either mixed with chalybeate waters, or are impregnated with carbonic acid.

Sulphur waters contain either no carbonic acid at all, like the springs of the Pyrenean spas, or at the most only a few cubic inches; Langenbrücken alone exhibits an amount of 20. An advantage arises from this deficiency, as the small amount of sulphuretted hydrogen is easily ejected by eructation.

CHAPTER II.

NITROGEN GAS IN MINERAL WATERS.

NITROGEN gas, as a component part of a mineral water, interests us almost exclusively in our estimation of the spas of Lippspringe and Inselbad, near Paderborn. At both places importance has been placed on the prescribed inhalation of an atmosphere rich in nitrogen gas, in consequence of which, in persons suffering from tuberculous diseases, the pulse is said to be retarded, the cough, and especially the spitting of blood, to be diminished, and altogether the change of substance, and the consumption of vital power to be checked. The old hypothesis as to a positive and specific effect proceeding from nitrogen gas in itself, has been now wholly relinquished, since it has been recognised as a most indifferent substance in every respect; and its advocates are now satisfied with explaining the effect of an atmosphere impregnated with nitrogen gas by the rarefaction it produces, i.e., by the relative diminution of oxygen; so that therefore such an atmosphere is rendered similar to the rarefied air on great elevations, as far as regards its amount of oxygen, and its effect as an aid to the respiration. This view is theoretically perhaps not without foundation, and it may be expected that it will be confirmed by experiment, and be made use of practically, as soon as any accurate investigation of the matter has taken place. Hitherto, however, all such investigation has been lacking; at least we cannot regard with confidence all that has hitherto been written upon this subject, with regard to Lippspringe and Inselbad. In the first place, we question with Lersch,¹ who is an authority in technical matters of the kind, whether

¹ *Hydrochemie*, p. 53 *et seq.*

the water of Lippspringe and Inselbad contains more nitrogen gas than many common waters; next, we lack accurate and reliable analyses of the gas contained in the air inhaled in the experiments and observations; in the third place, it is very questionable whether the air in these inhalation apartments is so strongly nitrogenous that in its deficiency of oxygen it resembles the air at a considerable elevation above the level of the sea; and thus everything that has been communicated to us with regard to the primary as well as the final effect of these inhalations, appears to us only a theoretic inference, and this all the more as the practical results asserted are doubted by many.

The results related by Hörling and Fischer have very much the appearance of a theoretic scheme laid down as to the effect of condensed and rarefied air (see p. 47 *et seq.*), namely, numbness of the head, heaviness of the limbs, indolence and drowsiness, slackening of the pulse following upon its acceleration, impeded (!) and therefore deepened breathing, while persons of delicate lungs are said at once to breathe more freely. These striking manifestations are moreover ascribed to an atmosphere which contains upon approximate calculation $\frac{1}{10}$ oxygen less than the air of level country; whilst we may estimate the relative diminution of oxygen as regards the respiration at elevations, for example, of 4,000 feet at 17 per cent., and at 14,000 feet (Mont Blanc) at 60 per cent., and yet at these elevations (see the first book) we find nothing at all of the effects here stated.

The following few statements must suffice for the present for practitioners.

1. The inhalations at the above-mentioned spas have been indisputably proved to be innocuous.

2. The advantage which they may have yielded in many cases, may possibly proceed from the increased expansion of the lungs (pulmonary gymnastics) necessarily combined with the inhalation.

3. It may be assumed theoretically that inhalations of any air rich in nitrogen, and consequently deficient in oxygen, would produce similar effects to a sojourn on a great elevation.

4. But for this, it would be necessary for these inhalations to be taken daily, not only for one hour, but for several, and in many cases even for many hours in succession.

5. Both the requisite experiments and the practical use of the inhalations, require (*a*) a large ventilated apartment, and such arrangements as may regulate the development of the gases, both as regards quantity and time; (*b*) and, above all things, the determination of the amount of nitrogen, oxygen, and carbonic acid in the atmosphere for inhalation, both with a change in the regulation and at various times. No experiment and no practical observation of a case has any value as regards the point in question, unless the proportion of these three gases have been approximately ascertained. Sufficient means are supplied for experiments in Bunsen's gasometrical methods, and upon slight practice they are easy to make use of; for practical application there are also empirical methods to be found which render possible an approximate determination of the amount of gas. Not till these conditions are fulfilled, i.e., not till the course of the effects and results stated can be demonstrated, will these statements be reliable, and not till then can these results be discussed. See the remarks upon Lippspringe, in the third and fourth books, on the treatment of Phthisis.

CHAPTER III.

CARBONATE OF SODA IN MINERAL WATERS AND ALKALINE SPRINGS.

Idea of
resolvents.

CARBONATE OF SODA stands among the remedies of balneo-therapy as the representative of those alkaline medicines which, from an early age, have been considered important in the characteristic class of *resolvents*. At the present stage of our science, we connect the word solution with the idea of processes which are in truth expressed in the word, and in its vulgar sense; namely, in the first place, the chemical action by which certain substances are in normal solution in the blood and in the juices of the tissues; and, secondly, the stimulation of fluid secretions, in which unorganised or organised products of disease are dissolved, and are then removed by the secretions and excretions. The first of these functions relates to the physiological importance to the blood of soluble substances, the second to clinical facts; both are admissible and conceivable, generally speaking, as regards carbonate of soda, but they are in no wise so satisfactorily confirmed and explained as pharmacodynamic and balneological works would lead us to suppose.

PHYSIOLOGICAL IMPORTANCE OF SODA.

Soda in the
blood.

1. The most important, because indubitable, fact is that the blood possesses a considerable and constant amount of soda, and this partly in chloride of sodium, which is directly ascertainable by the analysis of the blood, and partly in carbonate of soda, which, it is true, is only a product of the analysis of the ashes, but which,

according to chemical computation, must be regarded as carbonate, and from the considerable amount of carbonic acid in the blood, must even be regarded as bicarbonate of soda.

2. That function of the soda in the blood which, chemically speaking, is most surely established, is the maintenance of *the alkalescence of the blood*, by means of which the albumen and the fibrine are held in solution. We must, however, here mention that not merely the carbonate of soda, but the chloride of sodium also is necessary to this solution, no difference between the two salts having been at present ascertained, and each most probably being available in the place of the other. That the solution of the albumen and fibrine is dependent on the alkalescence of the blood, has been sufficiently proved, both by observation and by experiment; and it is also readily conceivable that, by the constant supply of acids from the food taken, a constant attack is carried on in the blood against this alkalescence, and that this carbonate of soda is especially adapted to meet this attack. While it combines with the strong inorganic acids to form the corresponding soda-salts, it promotes the transformation of the organic acids, for example, acetic acid, citric and lactic acids, into carbonic acid, and forms with them again carbonate of soda. Hence we find the alkaline salts of the vegetable acid consumed with food appearing again in the blood and urine as carbonates; and hence the effect of the former, apart from the local influence upon the membrane of the stomach and intestines, is perfectly similar to that of the latter.

Alkalescence of the blood.

3. Liebig has established the theory that carbonate of soda is the *vehicle of carbonic acid*, which is conveyed from the blood to the lungs, to be ejected by them. This idea is rendered very probable, both by theory and calculation, or rather the theory necessarily arises from the presence of carbonate of soda and carbonic acid in the blood.

Soda as a vehicle of carbonic acid.

4. *The holding in solution of the fibrine* in the blood is probably the most important influence in the effect produced by carbonate of soda on the change of substance.

Solution of fibrine.

The numerous current physiological and nosological theories with regard to the fibrine have not been found sound when compared with chemical facts; and, as a result of the latter, for the present we have only the very probable assumption that fibrine forms a transition-stage between albumen and excremental substances, urea, uric acid, &c., and that this transformation is connected necessarily with the solution of the fibrine in the blood. Presupposing the correctness of this assumption, the alkalescence of the blood would therefore be required as an essential condition for the normal change of substance, and the increase of this alkalescence would increase the retrogressive part of the change of substance. The first of these inferences must remain a theory, though well supported, so long as we possess no knowledge as to the state of the blood and of the change of substance on the diminution of the alkalescence of the blood; the second inference is confirmed by clinical experience and experiment. The prolonged use of carbonate of soda and other alkalies emaciates the body, increases the production of regressive metamorphoses in the urine, and what is still more important, diminishes the fibrine of the blood, and this, according to Nasse's experiments, about 14 to 25 per cent. Recent observations, however (Kemmerich, Rabuteau, and Constant), prove that the effect produced by alkalies on the increase of the retrogressive change of substance, belongs to *smaller doses*, and that larger doses very considerably diminish the oxidation of the nitrogenous combinations. Large doses have even a poisonous effect in causing paralysis of the heart; yet this effect belongs in a greater degree to potash-salts than to soda-salts. It also seems to be proved that potash-salts cannot be substituted in the blood for soda-salts.

Solution of
the
albumen.

5. The solution of the *albumen* in the serum of the blood, is, as we have mentioned, likewise connected, it is true, with the presence of carbonate of soda and chloride of sodium; and it has been also ascertained that, with the diminution of the albumen, the alkaline salts and the water increase; still there is at present an utter lack of information as to the causal circumstances, and as regards

any evidence that an artificially produced excess of salts actually diminishes the albumen.

6. The relation of carbonate of soda to chloride of sodium, as regards nutrition and change of substance, is a matter of the greatest practical importance—namely (*a.*) Both seem to concur, and to take the place of each other, in the solution of the albumen and fibrine in the blood; (*b.*) The chloride of sodium is more rapidly ejected, and exercises an excessive solvent effect on those elements of the blood more slowly, than carbonate of soda; (*c.*) This corresponds with the nutritive effect of moderate doses of chloride of sodium, compared with the emaciating effect of carbonate of soda; (*d.*) The experimental fact that chloride of sodium impedes the solution of the particles of the blood into albuminous fluid, seems to illustrate and to corroborate this conservative property of the common salt in the blood. Whilst, however, *large doses* of carbonate of soda diminish the change of substance (probably by decreasing the action of the heart), the contrary takes place with large doses of chloride of sodium; in the former case, there is a diminution of urea, in the latter, a considerable increase.

Carbonate of soda compared with chloride of sodium.

7. The direct effect of carbonate of soda on the *stomach* and *digestion* is only beneficial in small doses; larger doses, and the prolonged use of it, impair digestion, and diminish the appetite and nutrition. In cases of excessive acidity of the stomach, this is neutralised by the alkali, and the newly produced lactate of soda is absorbed. If, however, the dose be large, or if the acidity of the stomach be not excessive, it is likewise neutralised, and the act of digestion is *deprived* of it. Further changes of the functions of the stomach and intestines by means of carbonic acid are not known, but they may be supposed from its influence in disturbing the digestion and nutrition. Mineral waters containing soda produce a less disturbing effect in this respect than pharmaceutical alkaline preparations, and a corrective therefore seems to lie in the excess of carbonic acid, which is plentifully contained in these waters. Another corrective is also to be found

Effect on the stomach.

in the amount of *common salt*, which appears in most of these waters.

Diuretic
effect.

8. The *diuretic effect* of carbonate of soda is confirmed; it seems to be more rapid than that of chloride of sodium, and to be combined also with a greater secretion of the products of the retrogressive change of substance, but this only when taken in smaller doses.

Potash
and soda.

9. *Carbonate of potash* has an effect similar to that of carbonate of soda, with regard to its influence on the blood and on the change of substance, inasmuch as it combines with the chloride of sodium in the gastric juice and the chyme, to form chloride of potassium and lactate of soda. The latter is, however, absorbed and transformed in the blood into carbonate of soda; for this reason, the effect of carbonate of potash and of alkaline salts of vegetable acids upon the alkalescence of the urine, and upon several states of disease, is similar to that of carbonate of soda, although they cannot, as we have before mentioned, be substituted for each other in the permanent chemical constitution of the blood.

THERAPEUTIC FACTS AND EXAMINATION OF SUITABLE CASES.

We will now follow the above-stated chemical and physiological facts and opinions, with a series of therapeutic experiences and maxims, though the connecting link of accurate explanation between them is still most defective.

Albumen
dyscrasia.
Scrofula.

1. The *albumen-dyscrasia* of scrofulous diseases, which was currently accepted for a long period, was, it is true, convenient and pleasant, but it could not stand the test of physiological and pathological chemistry. Medical practice has also experienced the advantage of generally strengthening and supporting treatment; and for the stimulation of the functions of assimilation, courses of moderate common salt waters are preferred. On the other hand, carbonate of soda possesses a practical value when viewed from another aspect of antiscrofulous treatment, namely, for the rapid absorption of scrofulous exudations. The remedies, however, which are most rapid and successful in the absorption of scrofulous exudations, always at the same time disturb the formation of blood and the

nutrition; and hence it is requisite, and it is also generally approved of in medical practice, to choose those which are most rapid in their effect, and which, therefore, require the shortest period for attaining their object; such as mineral springs containing common salt, the internal use of preparations of iodine, and as the mildest of all, a course of Carlsbad water. In the latter, a moderate amount of carbonate of soda is combined with chloride of sodium and sulphate of soda, and it can be taken for a long time without interfering with the appetite or the digestion. Generally speaking, pure soda-waters are not prescribed for the treatment of scrofulous diseases, but are only tolerated, and indeed especially the weaker ones, and those containing common salt, the effect of which scarcely proceeds from the soda, but rather from the chloride of sodium and the carbonic acid.

Carlsbad
for
scrofulous
exuda-
tions.

2. *Acid gravel*, i.e., the concretions of urate of soda, Gravel. finds a decided remedy in strong soda-waters. We have at page 74 stated Scherer's opinion, who rejects the theory of an uric acid diathesis, and who attributes the origin of these concretions rather to the fermenting secretions of the mucous membrane of the kidneys and bladder. If from the use of carbonate of soda the uric acid in the urine diminish and disappear, the effect upon the uric acid concretions would, according to Scherer's opinion, be explained by the fact that the supply of the material forming these sediments is cut off. In truth, the diminishing of the uric acid not only constantly results from the use of soda-waters, but also from the use of other alkalis; and it has been especially proved by Münch in a series of physiological experiments as resulting from the use of carbonate of soda.¹ Münch found that the carbonate of soda at first diminishes the uric acid until it almost wholly disappears, but that this effect ceases again after some time in spite of the continued use of the remedy; if, on the contrary, a course of a strong soda-water produce this effect permanently, and even radically remove the evil, other influences must also be at work which are wanting in the use of the pharmaceutic

¹ *Archiv für Heilkunde*. vol. vi, 1863.

remedy : and these can alone be the plentiful amount of water which is known to be a powerful agent in diminishing uric acid, and all the other influences attending a course of baths and springs, especially the stimulating effect of carbonic acid upon the functions of the stomach.

Vichy.
Bilin.

Generally speaking, none but the stronger soda-waters have a rapid effect on the diminution of the uric acid and gravel; and therefore Bilin, which possesses 33 grains of bicarbonate of soda, and Vichy, with 37 grains, are especially used. The real chief of these remedies, however, is Vichy; and with this spa, strange to say, Carlsbad comes most into competition, though containing only 14 grains of bicarbonate of soda, while other waters containing an equally small amount of soda scarcely come into consideration at all in medical treatment. The amount of 7 grains of chloride of sodium, which Carlsbad possesses in common with Ems and other waters, can scarcely contribute to this effect; the amount of 18 grains of sulphate of soda is also too small; and it only remains for us to assume that either the peculiar quantitative combination of these salts or the heat of the water strengthens the effect of the carbonate of soda. Generally speaking, however, Carlsbad, as regards a rapid and radical effect, seems to hold an inferior position to Vichy.

Gout.

3. *Gout*.—We stated in the first book (p. 73 *et seq.*) that the secretion of uric acid is not increased in gout, but is diminished; if in spite of this, those remedies which diminish the uric acid in the urine have been proved as most useful in counteracting gout, in the explanation of their effect we must put this influence out of the question, and must seek for other reasons. Among accepted remedies, we may of course reckon carbonate of soda and the waters that contain it; and this effect is explained in general by the acceleration of the retrogressive change of substance, and by the emaciation and absorption of fat, which are observed as proceeding from its prolonged use. On the other hand, it must not be forgotten that this effect belongs to all methods of treatment which promote the retrogressive change of substance, especially also to the

plentiful use of water, and that we possess no observations which allow a comparison of these methods with each other with reference to their strength. If, moreover, only the strongest soda-waters, especially Vichy, have acquired a special reputation as a remedy against gout, we must, on the other hand, state that even these are far inferior to the complicated combinations of soda, chloride of sodium, and sulphate of soda, such as are afforded by the waters of Marienbad and Carlsbad; and while we find a constant and considerable effect produced by the latter in great diminution of fat, we feel inclined for the present to ascribe to carbonate of soda only a slight effect against gout, and in nowise one of a chemically specific character.

4. *Increased venosity* is a thing which is not, it is true, recognised by accurate physiological science, but which, nevertheless, is not to be dispensed with as a clinical idea of the complicated explanation of some conditions of health. Although it may not be possible to group together symptoms as constituting a form of disease corresponding with this term, still every practitioner is acquainted with a number of individual conditions to which no name in the nosological system belongs, and which are rather to be explained by the deficient decarbonisation of the venous blood. This may either be caused by an indolent mode of life, by excessive vegetable diet, or by disturbances of the functions, which do not prove any organic disease of the organs of assimilation and circulation, but frequently only a deficient state of nutrition in the venous vessels themselves. It is often accompanied with catarrhs of the most different mucous membranes, and often terminates in liver-disease, phthisis, and cancerous degenerations; conditions which occur more frequently in females than in males, and which perhaps represent in a weaker degree in the female sex that which in the male sex exhibits itself in more striking functional disturbances, as abdominal stasis or gouty dyscrasia. Whilst in the more striking cases of abdominal stasis, gravel, and gout, which are perhaps only higher degrees of so-called venosity, strong soda-waters, and especially common salt springs and the complicated springs of Marienbad and Carlsbad, are prescribed, in

Increased
venosity.

slighter degrees of this condition only weak soda-waters, especially those containing common salt, like Ems and Neuenahr, are indicated and found successful.

Catarrhs.

5. *Catarrhs*.—The effect of alkalies, and especially of carbonate of soda, in counteracting catarrhs, is universally known, and is familiar in all medical practice; all attempts at explanation, however, fall under the class of hypothesis, and the above-stated chemical and physiological importance of soda can in no wise be applied to this effect, which for the present can only be accepted as a purely empirical and clinical fact. Not only in chronic but also in acute catarrhs, the use of alkaline remedies facilitates the removal of the secretion, but in no wise, as is often thoughtlessly asserted, does it render it thin or fluid; but far rather, while it diminishes its quantity, it renders the mucus thicker; the more recent and acute a catarrh is, the more fluid is its secretion, and it is only in a chronic stage, and especially as the cure advances, that it becomes thick, because it is richer in epithelial cells. This process of cure appears to be accelerated by the use of alkalies, although we possess no accurate material for the explanation of this effect: the process must, of course, lie in that change of the membrane by means of which it produces healthy epithelia, but the *how* remains unexplained. The specific anticatarrhal effect cannot be attributed to the carbonic acid in the soda-waters, because pharmaceutical preparations of carbonate and vegetable alkalies—for example, acetate and citrate of potash—produce the same effect. The advantage of soda-water proceeds, probably, from the simultaneous effect of the plentiful liquid taken, the absorption of which is assisted by the carbonic acid. The amount of common salt contained in these springs seems to be beneficial in some cases of catarrh.

Bronchial
catarrh.

In *catarrh of the respiratory membrane*, practical experience has proved the superiority of those soda-waters which contain a considerable amount of chloride of sodium in addition to the carbonate of soda, and which are, therefore, called alkaline muriatic waters; yet there is a lack of comparative investigations and observations as to the

share of common salt in this effect, especially as to whether the absorption of exudations, the stimulation of the functions of the bowels, or the participation of the chloride of sodium in forming cells, is especially to be taken into consideration. Probably, the latter is the case; at any rate, it appears so from the physiological importance of this salt. All soda-waters contain some chloride of sodium; but the limit between simple and muriatic soda-waters may be defined by about an amount of from 7 to 8 grains in 16 ounces; at the same time, we must mention that a small amount of common salt can be added to any water, and that this would characterise it as muriatic, without interfering with its other properties. The amount of common salt in the principal soda-waters is as follows (in proportion to 16 ounces): Giesshübel, Geilnau, Salzbrunn, Neuenahr, Rohitsch, Füred, Rippoldsau, Petersthal and Cudowa, less than 1 grain; the Fellahthal springs, $1\frac{1}{2}$ grains; Bertrich and Bilin, 3 grains; Apollinaris, $3\frac{1}{2}$ grains; Fachingen and Vichy, $4\frac{1}{2}$ grains; Ems, 6 to 7 grains; Carlsbad, 7 to 8 grains; Franzensbad, 6 to 9 grains; Elster, 8 to 14 grains; Roisdorf, 3 to 14 grains; Gleichenberg, 4 to 14 grains; Marienbad, 3 to 15 grains; Selters, 17 grains; Luhatschowitz, 20 to 33 grains.

Amount of
common
salt in
soda-
waters.

Much influence belongs to the temperature of the water, not only as regards its absorption, but also as regards expectoration. Warm water in itself is an expectorant, because the heat is physically communicated from the œsophagus to the lungs and bronchial mucous membrane. This influence, also, may be regulated at will; most soda-waters contain sufficient carbonic acid to bear a partial loss of it by heating or cooling, without interfering with the effect. The usual simple acidulated alkaline springs are cold, with the exception of Vichy, where most of the springs are from 30° to 41° Cent. (86° to 105.8° Fahr.), and Neuenahr, where they are from 22.5° to 38° Cent. (71.6° to 100.4° Fahr.). Of all the soda-waters containing common salt, Ems alone is warm, viz., 27.5° to 46° Cent. (81.5° to 114.8° Fahr.); of the alkaline saline waters, containing sulphate of soda in addition to carbonate of soda and chloride of sodium,

the springs of Tarasp, Marienbad, Rohitsch, and Füred are cold, and those of Carlsbad warm (47° to 71° Cent., 116° to 159° Fahr.); the acidulated alkaline chalybeates, Franzensbad, Elster, and others, are all cold.

Catarrh of
the
bladder.

In *catarrh of the mucous membrane of the bladder* a considerable amount of common salt seems of less importance, and the principal effect seems to depend on carbonate of soda, because those soda-waters which prove most efficacious in cases of long standing possess a strong amount of carbonate of soda, but a very slight one of common salt, such as Bilin, Fachingen, and, above all, Vichy. Probably in this case, the specific, i.e., unexplained effect of the soda on the mucous membrane is assisted by the alkalescence of the urine produced by the treatment, because the improvement often occurs at once, and because the mucus of the bladder is deprived of a portion of its fermenting material. Great precaution is, however, necessary not to induce by too great alkalescence of the urine a state of alkaline fermentation. If, accordingly, after temporary improvement, renewed pain occur, the course of treatment must be at once stopped until the urine again becomes slightly acid. The novice, however, ought not to regard the treatment of severe catarrh of the bladder as a very easy matter. None but slight cases are cured by the simple use of soda-water; severer ones require also local treatment—frequent washing out of the bladder in order to remove the mucus, which is not alone the product of the disease, but which keeps up the disease, and alterative and astringent injections.

This mode of local treatment is not to be neglected in the appreciation of *Wildungen* for cases of vesical catarrh, gravel, pyelitis, and such like diseases. The Georg-Victor spring at Wildungen, which is the one in question in such cases, is rich in carbonic acid; the other essential constituents being only carbonates of lime and magnesia. The water is transmitted, and is frequently beneficially used as a beverage during the day in courses of Carlsbad and Vichy, and other active waters. At the spa itself, however, important independent results are recorded; which we have, indeed, no reason to dispute,

but in estimating which we must take into consideration not only the diuretic and lixiviating effect of the water, but the practical knowledge of the local doctors, who are masters in the general and local treatment of this troublesome branch of practice.

If a considerable deposit of phosphates be combined with the catarrh, soda-waters, used for a long period and in large doses, easily prove injurious; also in cases of catarrh of long standing accompanied with considerable desquamation of epithelium. In the latter case, a course of iron may be found efficacious.

Catarrh of the vaginal and uterine mucous membrane, Fluor albus.
if not locally caused by ulceration, is either a symptom of anæmia or a symptom of those conditions which we have designated above as 'venous.' In the latter case, long-continued courses of weak soda-waters are beneficial to the general condition and the local complications, but in severer cases, the application of local remedies is very rarely to be dispensed with. If anæmia to any great extent be the cause or the attendant of the disease, soda-waters must be used with moderation, because their long continued use easily disturbs nutrition and sanguification. Generally speaking, catarrh of the sexual mucous membrane, like that of the conjunctiva of the eyes, seems after a short duration to free itself of the general cause producing it, and not to yield to general treatment. A severe case of fluor albus is rarely cured by medicinal waters, and many of the statements with respect to it belong to the realm of fable.

Chronic catarrh of the stomach is in no wise such Catarrh of the stomach.
a frequent illness as its constant mention might lead us to suppose. If, because the stomach is covered with a mucous membrane, every disturbance of its functions is to be designated as catarrh, there is certainly no more constant malady than catarrh of the stomach. Most cases, however, of disturbance of the functions of the stomach are connected, not with the secretion of the mucus, but with that of the gastric juice, and, moreover, with the innervation and action of the stomach; and fall under the clinical complaints of excessive or deficient acidity, cardialgia,

atony, and flatulence of the stomach—complaints which are frequently, though not appropriately, designated by the general name dyspepsia, and far more erroneously as catarrh of the stomach. Chronic catarrh of the stomach is a not very frequent and is almost always a very severe malady, producing grave derangement of nutrition, and very often phthisis and tabes dorsalis. Direct causes may almost always be traced which have had a direct influence upon the mucous membrane of the stomach, especially nicotine, perchloride of mercury, and, in some few instances, excesses in eating and drinking, which more frequently produce atony of the stomach. The characteristic symptom is an abundant secretion of mucus accompanied with an inclination to vomiting, and generally with impure breath, besides defective digestion and emaciation. Severe cases of long standing are very seldom cured, in spite of the boasted assertions of balneological literature. Strict and consistent diet, and astringent remedies, such as nitrate of silver, and especially acetate of zinc, as well as rhubarb and bark, are occasionally useful; and these remedies are assisted by the dietetic use of acidulated waters, in cases where carbonic acid is borne. Generally speaking, the effect of medicinal waters in severe catarrh of the stomach seems for the most part to proceed from the stimulating influence of carbonic acid. With regard to its prognosis and treatment, catarrh of the stomach is independent of its cause, but is dependent on the individual state of the disordered stomach, which is as incalculable beforehand as that of the healthy stomach. Hence in catarrh of the stomach, as in all other maladies, an empirical experiment is often necessary; one remedy after another must be tried, and even one diet after another, and it not unfrequently occurs that, after a soup-diet has been tried in vain, stimulating food and things strictly interdicted in most handbooks, such as vegetables, pickled cabbage, peas, beans, lentils, and black bread, are found useful. The following statements as to the treatment of catarrh of the stomach with the use of medicinal springs, are the result of sober experience.

(a.) *Most cases designated as catarrh of the stomach*

do not belong to catarrh of the stomach, but to the various forms of *dyspepsia*, *acidity*, *atony*, and *flatulency*. Combined with careful diet, adapted to the individual case, carbonic acid is in many instances an adequate remedy, acting both as a stimulating and as a soothing influence; and where acidity prevails, the carbonate of soda, carbonate of magnesia, and carbonate of lime contained in mineral waters act as palliative remedies, though *only* as such, and the effect lasts no longer than the use of them. The stronger soda-waters ought to be avoided, and the lime-waters have the advantage of stopping any diarrhoea existing at the time, or, at any rate, of not increasing it, as the soda does. Most of these cases require the use of cold springs in small and moderate doses; the advantage of warm waters depends upon individual circumstances, and is all the more apparent the more the malady is accompanied with neuralgic symptoms.

(b.) The more that *atony* of the stomach prevails, the more are stimulating remedies required, such as strong common salt waters, chalybeate waters, carbonic acid, and cold waters. If mineral waters containing lime are recommended for counteracting the flatulence that exists at the same time, by absorbing the gases, this is one of those maxims which rest on theory alone. Pharmaceutic doses of from 10 to 30 grains of carbonate of lime, and glasses of lime-water, amounting to a quart or more daily, have this absorbing effect on the gases of the stomach; but the amount of lime in mineral waters, compared with concentrated lime-water, is so small that it can scarcely be taken into consideration; and we do not believe that any considerable accumulation of gas has ever been absorbed by any of these mineral waters. Of the so-called lime-waters, Wildungen contains 5·4 grains of carbonate of lime, Lippspringe 5·2 grains, Weissenburg 0·8 grains, and Leuk 0·3 grain. In most soda-waters it appears in a quantity of from 1 to 5 grains, and only a few contain quantities which can be compared with the amount of quick lime in lime-water, Rohitsch, Rippoldsau, Petersthal, and Borsék containing as much as 11 grains. Among the drinkable common salt waters, Kissingen has

Carbonate
of lime
in waters.

4 to 8 grains of carbonate of lime, Homburg 5 to 11, Soden 2 to 8, Cannstatt 7 to 8, and Nauheim 11 to 16; the pure steel-springs have from 1 to 7 grains, and most of the sulphur-waters only a few grains. In many cases the lime-water is not sufficient to produce this palliative effect, and then charcoal is to be recommended. Very frequently, with and without the preceding resultless use of mineral waters, we have quickly and permanently removed complex symptoms of cardialgia, pyrosis, and flatulence, occurring especially in females of an anæmic tendency, or when nursing, by using Heim's empirical composition of magnesia, charcoal, and quassia.

(c.) *Real chronic catarrh of the stomach*, i.e., excessive secretion of mucus, with its important consequences, requires, as a rule, *waters containing carbonic acid*, besides the powerful stimulant of *common salt* in moderate quantities, not exceeding 60 grains; and the choice of the waters, which vary in strength, is regulated chiefly by the individual condition of the stomach, which must be ascertained by experiment. The more usual of these waters contain chlorine combinations—chloride of sodium, chloride of magnesium, and chloride of potassium—in the following amounts:—*Baden-Baden*, 18 grains in 16 ounces; *Cannstadt*, 16 to 20 grains; the weaker springs of *Soden*, 17 to 27 grains; *Cronthal*, 22 to 28 grains; *Kissingen*, 19 to 48 grains; *Mergentheim*, 52 grains; *Bourbonne*, 52 grains; *Homburg*, 60 to 138 grains; and *Wiesbaden*, 57 grains. These waters stand in the following succession, as regards their amount of carbonic acid: Homburg, 43 to 55 cubic inches; Kissingen, 41 to 48; Cronthal, 33 to 40; Soden, 14 to 48; Cannstatt, 19 to 27; Mergentheim, 9; Wiesbaden, 6; and Baden, 1.5. The choice between warm and cold springs is regulated likewise partly by the individual condition of the stomach and partly by the possible attendant diarrhoea, in which case warm waters are to be preferred, because they are more rapidly absorbed in the stomach, and, consequently, the common salt cannot produce any effect on the internal membrane. Mergentheim, Kissingen, Homburg, and Cronthal are cold; the springs of Soden are from 15° to

24° Cent. (59° to 84·2° Fahr.); Cannstadt, from 17·5° to 20·5° Cent. (63·5° to 68·9° Fahr.); Baden, from 46° to 71° Cent. (114·8° to 159·8° Fahr.); and Wiesbaden, 62° to 70° Cent. (143·6° to 159·8° Fahr.). The favourite addition of common salt to an otherwise suitable acidulated spring, or the mixture of a strong common salt water with a simple acidulated spring to a fixed amount of dilution, reconciles many differences, and is often used in domestic practice and at spas, with the same result as the use of different natural springs. [One of the best modes of treatment of chronic catarrh of the stomach consists in the careful use of the stomach-pump, and in the washing out of the stomach by means of acidulated alkaline waters, such as Vichy, Neuenahr, Ems, &c. We may add that we have seen cases of chronic catarrh and subsequent dilatation of the stomach, which we regarded not as the cause, but as one of the first symptoms of paralysis of central nature.]

Chronic catarrh of the bowels is very often mentioned as the object of the most different medicinal waters. It is, however, not so as chronic catarrh, but only as the consequence of other maladies which are accessible to the effect of medicinal waters; for example, venous abdominal stasis, liver-diseases, and enlargement of the mesenteric glands. Among the mineral waters indicated for these conditions, the weaker and warmer ought to be selected, as not producing an irritating and aperient effect upon the intestinal mucous membrane. In cases of independent catarrh of the bowels, generally speaking, the most effective remedies are those which do not belong to balneotherapy. On the other hand, in obstinate cases, warm baths are rarely to be dispensed with as a palliative remedy; and in cases in which the catarrhal irritation of the bowels arises from great weakness of skin and repeated colds, the remedies for weakness of skin (p. 110) must be used, and in such cases any internal course of treatment is useless, unless the cold water system, sea-bathing, or the thermal sool-baths of Rehme and Nauheim, have been able to remove the inclination to catching cold.

Catarrh of the cystic duct, which is the most frequent

Catarrh of
the
bowels.

Icterus

catarrh-
alia.

cause of *jaundice*, is frequently treated with mineral waters, but, as far as our experience goes, its course is rarely shortened. The prognosis is in general good, but the progress of the malady is for the most part slow, and requires gentle treatment. It is only when the disease has been of long continuance, and is accompanied by symptoms of an enlargement of the liver, that an energetic treatment is necessary; and for this, *Carlsbad* and *Marienbad* are especially to be recommended as producing a powerful effect upon the liver, combined with the advantage of not disturbing the digestion and nutrition, provided a good *régime* be maintained. Simple soda-waters, which frequently in a short time are beneficial in removing catarrh of the bronchial membrane, seem, like other remedies, to exercise no influence upon catarrh of the cystic duct.

Exuda-
tions.

6. In *promoting the absorption of exudations*, soda-waters may be used as a remedy, as they promote the decarbonisation and the dilution of the blood, and have also a diuretic effect, and when taken in small doses they accelerate the change of substance. It has been already mentioned that for the rapid diminution of scrofulous hypertrophic glands a course of *Carlsbad* waters is very efficacious, although *Carlsbad* is not a popular resort for these maladies. For the absorption also of gouty, rheumatic, and inflammatory joint-exudations, mineral waters, combined with bath treatment, are considered efficacious, especially common salt and *Carlsbad* waters. Soda and common salt waters also produce an effect on the absorption of dropsical exudations and on pleuritic exudations,

Empyema.

by means of the increased diuresis caused by them. As regards the latter, it must, it is true, not be forgotten that, in most cases where life is retained, nature alone keeps up a process of absorption which can be aided by *régime* and mild therapeutic treatment, and that therefore we cannot ascribe every result to the specific effect of the remedies employed. Generally speaking, muriatic alkaline waters and moderately strong common salt waters are to be preferred in cases of considerable exudations, because the loss of albumen occasioned by the exudation, and the anæmia consequently arising, call for a remedy and

a mode of treatment promoting both the nutrition and the formation of cells. If, however, the anæmia be very great, especially in cases of great pleuritic exudation and of considerable hepatisation of the lungs, the use of iron is indicated above everything else; and in these cases the use of small doses of pharmaceutical preparations of iron is to be preferred to that of chalybeate waters containing carbonic acid, because the injured state of the respiration and of the function of the heart cannot usually bear the irritation of the carbonic acid, and moreover the stomach, which ought to digest food plentifully, prohibits an excess of water.

7. That carbonate of soda and the alkalies generally increase the *secretion of bile*, is an often repeated assertion, arising from the chemical character of the bile, but neither proved by clinical observation nor by experimental investigation. The plentiful use of water, and of those remedies which violently stimulate the secretion of the intestinal mucous membrane, and thus probably irritate the liver, is the sole means we know of for producing any distinct effect upon the increase of the bile and particularly of the water it contains. By this means the fixed component parts are, it is true, relatively diminished, but are absolutely and in a given time increased, just as in the effect of water on the urine. Among the remedies which, by stimulating the bowels, indirectly produce this effect, are sulphate of soda, sulphate of magnesia, and common salt in larger aperient doses. Clinical experience and experiment are, however, silent as to the use of carbonate of soda in this respect, and all assertions as to the increase of the amount of water and alkali in the bile by means of soda, and as to the therapeutic consequences of this effect, are theoretic abstractions. The effects produced in this way by Carlsbad and Marienbad, may be traced to their amount of Glauber's salts; but in the use of soda-waters we have vainly sought for symptoms which would evidence an increase of the bile. Hitherto it is only known that, when an excess of soda is taken, it is quickly evacuated through the urine; but its passage into the bile is nowhere ascertained. And thus we must for the present ascribe the

Function
of the
liver.

result of a course of soda-waters, not possessing any considerable quantities of common salt and sulphates, to the increase of water taken.

Gall-
stones.

On the ground of this assumption, soda and alkalis generally have been frequently used for gall-stones, and it has been thought that these sedimentary deposits could be dissolved by soda-waters, because their component parts are soluble in alkaline fluids. If these attempts were successful, they would indeed to some extent establish the theory of the increased alkaliescence of the bile; they are, however, like all other methods tried, so little successful that the possibility of the solution of gall-stones is now generally put out of the question, and nothing more is aimed at but the symptomatic alleviation of the stone-colic and the plentiful use of fluids, for the purpose of *mechanically carrying away* the concretions. This latter effect belongs to most medicinal waters, and none but aperient waters increase also the secretion of the bile, and consequently possibly the evacuation of the stones.

Diabetes,

8. *Diabetes*.—The important facts afforded by experience upon this subject are briefly as follows:—

The two
characteristic
forms of
diabetes.

In *medical practice* we may distinguish two forms of this disease, the difference of which, as regards both prognosis and treatment, is very important; namely, a milder and a severer form, which the author will designate by the names of the *greater* and *lesser diabetes*.

Greater diabetes is rapid in its progress, and for the most part speedily manifests the symptoms of phthisis. The symptoms of the malady are extreme, the amount of saccharine matter considerable, for the most part not less than 4 per cent., and often reaching 10 or 12 per cent. The sexual power speedily becomes extinct, and the etiology as a rule may be traced to very strong and general influences, especially to a sorrowful existence, to excessive mental effort and great dissipation, and games of hazard at night.

Lesser diabetes is slower in its progress, often extending over 10 or 15 years, and is capable of being improved and arrested in its course. The symptoms are of a mild character, less frequently ending in phthisis, the amount

of saccharine matter is often only $\frac{1}{2}$ to 1 per cent.; the sexual power is less weakened, and occasionally not at all so; and the etiology of the malady is less frequently to be traced to the above-mentioned general causes, often to no probable conditions, but to diseases of the nervous system as a symptom and consequence of them. The author, who yearly comes into contact with a number of cases of neurosis, has frequently observed a very slight amount of saccharine matter in the urine in cases of *tabes dorsalis*, softening of the brain, spinal irritation, and especially in *sciatica*: and he has seen several instances in which the constancy of this symptom made the illness assume the form of the lesser diabetes. This important observation, especially as regards *sciatica*, instances of which will be multiplied by attentive investigation, has been confirmed also by others.¹

In all cases of lesser diabetes which we have observed, the use of Carlsbad waters has very rapidly and considerably diminished the saccharine secretion, frequently even on the second day, and has effected great improvement in several cases in the course of months and years. The author is acquainted with a foreign physiologist, well known also in Germany, whose urine has for 17 years contained a large percentage of saccharine matter, without causing the man, now 67 years of age, to regard himself as an invalid with respect either to his general health or to his diet. In eight cases of *sciatica* we have on five occasions observed an amount of from $\frac{1}{2}$ to $2\frac{1}{2}$ per cent. of saccharine matter, and once with the latter amount a considerable diminution of the weight of the body; this, however, as the sufferer was a very corpulent man, was overlooked at home, and even this patient apparently recovered with the use of the Carlsbad water. From such experiences, we are inclined to designate some of the cases of lesser diabetes as *symptomatic diabetes*, and to characterise them with a favourable prognosis. The author has observed a very striking instance, when, in connection with hæmorrhoidal affections of the rectum, chronic catarrh, and paralysis of the bladder, diabetes developed itself. The usual tests, however, did not show any sugar, until by local treatment

Carlsbad
in cases of
diabetes.

¹ See Eulenberg and Guttmann, *Pathologie des Sympathicus*, 1873, p. 194.

of the bladder the amount of fermenting mucus had been much reduced. In this case the internal use of Carlsbad water, combined with the thermal baths of Rehme and mixed diet, removed the diabetes, which has not returned after 14 years' observation.

While the author has in all cases of lesser diabetes observed a more or less considerable result attending the use of the Carlsbad water, he can also confirm the experiences of Carlsbad physicians in cases of greater diabetes: namely, in patients still living and in those who have since died, an improvement of the disease and a check to its progress have been effected by the Carlsbad waters, presupposing, 1, that the cases generally have not made rapid progress from the first, and 2, that they were not yet accompanied with phthisis. Indeed, in several cases, in which, though the progress was apparently not rapid, the Carlsbad waters have failed in proving efficacious, the illness has speedily turned into consumption, and thus the ill-success of the medicinal spring might almost have been considered as a prognostic sign.

In our own cases we have strictly regulated the diet only in greater diabetes, and have limited the patients *as much as possible* to animal food; in lesser diabetes we have paid no regard at all to the usual dietetic prescriptions, but have adapted them entirely to the individual condition of the stomach and the general condition. At the same time, however, we have always given attention to the weight of the body, and daily observed the amount of saccharine matter; and from these two points we have decided as to the suitability or unsuitability of the diet.

Carlsbad
and
Vichy.

The choice between Carlsbad and Vichy still remains to be explained. Vichy is a purely alkaline water, and contains about 38 grains of bicarbonate of soda, whilst Carlsbad only contains 14 grains; the latter, moreover, has 19 grains of sulphate of soda and 8 grains of chloride of sodium. In its amount of bicarbonate of soda and chloride of sodium Ems is about equal with Carlsbad, and nevertheless Ems has almost always proved unsuccessful in the treatment of diabetes. From this we may suppose that the smaller amount of soda in the Carlsbad water (com-

pared with Vichy) is not compensated by the amount of common salt, but by the amount of sulphate of soda,—that therefore the 14 grains of bicarbonate of soda, combined with the 19 grains of sulphate of soda at Carlsbad produce a similar effect to that of the 38 grains of bicarbonate of soda at Vichy. The author has only experimented with Carlsbad water, because he was not inclined to change the remedy already tested with any others. But for the establishment of this parallel, and for ascertaining the kind of effect produced by soda, the following investigations are necessary:—

1. Comparative observations upon one and the same sick person with Carlsbad and Vichy waters, the same diet being taken and no other remedies used:

Future
investiga-
tions.

2. Observations, not merely as to the change in the amount of saccharine matter secreted during the treatment, but also as to the amount of urea in the urine, and especially as to the excretion of soda in the urine, in order to learn whether and in what quantity and for how long a time the soda is retained in the blood, for the decrease of the saccharine matter:

3. The repetition of the experiments of Mitscherlich,¹ as to the effect of alkali not dissolved in a carbonic acid water; experiments which have yielded, as is well known, negative results, but which, it appears, have been only made in severe cases of greater diabetes.

The theory of the effect of soda has not been brought one step nearer its explanation since the reform which Pavy introduced into the hitherto current opinions of Cl. Bernard. All information is still lacking on the part of organic chemistry which might render any pharmacodynamic explanation possible. Other soda-waters as well as Vichy are, of course, adapted to the symptoms, namely, Fachingen, Bilin, Lubatschowitz, Neuenahr, and others.

4. *Stasis or passive congestion of the abdominal organs*, enlargement of the liver and spleen, corpulence, and similar conditions, likewise belong to the cases requiring soda-waters; yet it is only the slighter cases which fall under the clinical head of increased vesity, for

Passive
congestion
of the
abdominal
organs.

¹ *Arzneimittellehre*, b. iii. p. 214.

which soda-waters are sufficient, and then only the weaker kind: all severer cases require the use of common salt-waters and of complicated springs containing, in addition to carbonate, also sulphate of soda and chloride of sodium, such as Carlsbad, Marienbad, and the like. In the latter spas the amount of soda is weak enough, and the amount of chloride of sodium and sulphate of soda is strong enough, for the specific effect of the waters to be ascribed to the presence of the latter elements. The expression 'mild Carlsbad,' which is often applied to soda-waters, expresses this circumstance plainly, but it has no longer by any means the practical importance of former times, since the excessive daily doses of the waters, both at Carlsbad and Marienbad, have been limited, and the result has been looked for with greater certainty from non-aperient doses. The conditions mentioned are, therefore, estimated at the springs in question.

CHIEF ALKALINE OR SODA-WATERS.

We have already alluded at page 299 to the importance of baths supplied from soda-springs. The soda in the following remarks is mentioned as the bicarbonate. As in internal courses of waters a small quantity of protoxide of iron has to be taken into consideration, and this all the more when it is dissolved in a gaseous water, and as the carbonate of lime in some of these waters exists in such a measure that at any rate it assists in removing acidity from the stomach, we will give a complete analysis of the more important waters.

Warm and
cold soda-
waters,

Only a few of the soda-waters are *warm*; most of them are *cold*. The more the locally stimulating effect of the carbonic acid is aimed at, the more are the cold springs to be preferred, especially in atony of the muscles of the stomach and bowels. On the other hand, the more the absorption of the soda and its transmission into the blood are desired, the more do warm waters, generally speaking, meet the object in view; and the stronger the amount of soda, the more must the heat of the water assist in facilitating absorption. The cold waters, which are rich in

carbonic acid, have the advantage that they can be warmed, and can be drunk warm at a distance from the spring without losing too much carbonic acid, which is not the case to the same degree with the warm waters, poorer as they are in carbonic acid.

Where the soda-springs bubble up warm, their use is of course more convenient; and hence it is that in all conditions requiring the effect of soda upon the blood, the thermal are preferred to the cold soda springs. This explains why *Ems* and *Neuenahr*, in Germany, are so much frequented, and *Vichy* and *Mont Dore*, in France, compared with the cold springs, most of which are but slightly visited or only used for transmission abroad.

SIMPLE ALKALINE OR SODA-WATERS.

These contain little or no chloride of sodium and sulphate of soda in addition to their carbonic acid and carbonate of soda; they have, moreover, as regards effective component parts, only various quantities of carbonate of lime and small quantities of carbonate of protoxide of iron. The springs of *Vichy* and *Neuenahr* are warm, and are, therefore, abundantly used on the spot, both for baths and drinking: of the cold springs, *Salzbrunn* is the only one much frequented; the others are chiefly used for transmission abroad, and are little or not at all used on the spot.

Simple
soda-
waters.

Vichy, on the Allier, 800 feet above the sea, in a broad valley with a mild climate, is the most frequented spa in France, and perhaps in all Europe. The arrangements are on a magnificent scale. Nine rich springs supply the water for baths and drinking; the temperature of these varies from 10° to 44° Cent. (50° to 110·2° Fahr.), but their chemical composition presents no great differences. The best known spring is the Grande-Grille, of 45° Cent. (113° Fahr.), and containing the following amount in 16 ounces:—

Bicarbonate of soda	. . . .	37.6	grains
" potash	. . . .	2.7	"
" magnesia	. . . .	2.3	"
" lime	. . . .	3.3	"
" protoxide of iron	. . . .	0.03	"
Chloride of sodium	. . . .	4	"
Silica	. . . .	0.5	"
Carbonic acid	. . . .	12½-14	cubic in.

The main visitors are those suffering from gravel, stone in the bladder, catarrh of the bladder, gout, and diabetes, and all that was stated above with regard to the cases adapted for the use of soda-waters may be applied to these. The belief has, it is true, given way that stones are dissolved by the use of alkaline remedies; nevertheless, however, many such sufferers are to be found at Vichy, some of them upheld by this deceptive hope, and others trusting that the formation of new deposits may be thus prevented. Besides the cases mentioned, almost all maladies which are treated with medicinal waters appear among the visitors at Vichy: dyspepsia, catarrh of the stomach, enlargement of the liver and spleen, stasis in abdominal organs, ovarian tumours, chronic infarction of the uterus, and chronic rheumatism of the muscles and joints. It is usual in Germany to avoid such strong soda-waters in cases of catarrh of the stomach, and to prefer those of a weaker and cooler kind; while in severe cases of abdominal stasis (passive congestion), as well as in enlargements of the liver and spleen, the preference is given to waters containing sulphate of soda and common salt. The French, however, likewise send cases of this kind frequently to Carlsbad, Marienbad, Kissingen, and Homburg. The adaptation of Vichy for rheumatism refers chiefly to the baths. (Drs. Dubois, Durant-Fardel, Willemin, and other physicians.)

[For exportation, the cold springs of *Hauterive* and *St. Yorre*, richer in carbonic acid than the warm springs, possess in many conditions great advantages.]

Neuenahr.

Neuenahr, in the valley of the Ahr, 1½ hour from Remagen and Sinzig, and half an hour from Ahrweiler, situated 276 feet above the sea, has been in use for the last fifteen years, and is rapidly flourishing with its good

public gardens and excellent buildings; it possesses, in addition to a richly gaseous but otherwise poor cold spring, four warm springs, varying from 34° to 40° Cent. (93·2 to 104° Fahr.), but otherwise similar in constitution:—

Bicarbonate of soda	8·2 grains
„ „ magnesia	2·5 „
„ „ lime	2·4 „
„ „ protoxide of iron	0·04 „
Chloride of sodium	0·7 „
Carbonic acid	17 cubic in.

The springs possess accordingly somewhat less carbonate of soda than, and about as much carbonic acid as, those of Ems, and they differ from these but little in temperature; on the other hand, they do not contain the fourth part of the amount of soda possessed by Vichy, they have somewhat more carbonic acid than that spa, and no chloride of sodium at all (0·7), while the latter appears to an extent of 4 grains at Vichy, and of 7 grains at Ems.

Neuenahr, like Ems, is a weaker soda-water, but without common salt. The climate is mild, the bath arrangements good; the neighbourhood is beautiful, and rich in vegetation. (Drs. Richard Schmitz, Unschuld, and other physicians.)

[*Mont Dore* may be mentioned here as well as amongst Mont Dore. the indifferent springs and climatic health resorts. It lies in a charming valley of the Auvergne mountains (Department Puy-de-Dôme), about 3,300 feet above sea-level, and possesses a cold, and several warm springs (106° to 108° Fahr.), somewhat similar in composition to *Neuenahr*, with only about half the amount of carbonate of soda, but rather more chloride of sodium, and could therefore claim a position amongst the muriated alkaline waters. It is well provided with piscines, and separate baths, douches, and arrangements for inhalation, and it enjoys considerable reputation in the various forms of chronic catarrh of the respiratory mucous membrane and rheumatism. The elevated position is no doubt here of great influence. Distance about three to four hours' drive from the station of Clermont-Ferrand.—Drs. Chaboris-Bertrand, Riche-lot, &c.]

Bilin.

Bilin, in Bohemia, two hours from Teplitz, possesses the strongest soda-spring in Germany; it is, however, but little used on the spot, but is sent away in large quantities. It is cold, and contains in 16 ounces:—

Bicarbonate of soda	33 grains
" lime	4·3 "
" magnesia	1·6 "
" iron	0·08 "
Sulphate of soda	6·3 "
Chloride of sodium	2·9 "
Carbonic acid	33·5 cubic in.
Temperature	12° C. (53·6 F.)

Fachingen.

Fachingen, in the valley of the Lahn, is also only transmitted to other parts.

Bicarbonate of soda	28 grains
" lime	2·8 "
" magnesia	2·3 "
" protoxide of iron	0·1 "
Chloride of sodium	4·5 "
Carbonic acid	33 cubic in.
Temperature	10° C. (50° F.)

Fachingen and Bilin are, next to Vichy (50° Fabr.) [and Vals], the strongest soda-waters, and like those of Vichy they are used in the more serious cases, when the introduction of considerable quantities of soda into the blood is necessary; therefore, in severe catarrhs, especially catarrh of the bladder, and in gravel and gout. The two are scarcely to be distinguished from each other. Fachingen contains 5 grains of bicarbonate of soda and 0·03 grains of protoxide of iron more than Bilin; the amount contained by the latter is, however, too small (0·1) to produce any perceptible effect of iron. Both generally require to be heated, if the absorption of larger doses of soda is desired.

Teinach.

[*Teinach*, near Caln, in Würtemberg, in a beautiful valley of the Black Forest, 1,225 feet above sea-level, possesses a weak acidulated alkaline and a chalybeate spring. The influence of the Black Forest climate in a sheltered valley is to be added to the virtues of the springs. It is a quiet place with satisfactory accommodation in the 'Kurhaus,' but always full in July and August.

A hydrotherapeutic establishment further increases the medical resources of the place, which are under the direction of Dr. Wurm.]

The springs of *Preblau*, in the Leibach province in Carniola, and those of *Fellathal*, in the Klagenfurt province, are perfectly similar. *Gieshübel*, in Bohemia, near Carlsbad; and *Geilnau*, in the Nassau, are two weaker cold soda springs of tolerably pure constitution, mainly distinguishable from each other by the amount of carbonic acid, which appears to a double extent in the former. The amount of soda in both is strong enough to produce a moderate effect, and on the other side, it is weak enough to allow of the waters being recommended to healthy persons as acidulated drinking waters.

Preblau.
Fellathal.
Gieshübel.
Geilnau.

	Gieshübel	Geilnau
Bicarbonate of soda . . .	10 grains	8 grains
" lime . . .	2 "	3.7 "
" magnesia . . .	1.4 "	2.8 "
" protoxide of iron . . .	0.3 "	0.3 "
Carbonic acid . . .	55 cubic in.	23 cubic in.
Temperature . . .	9° C. (48.2° F.)	10° C. (50° F.)

Amongst the acidulated alkaline waters for table use the most agreeable, and, at the same time, in certain morbid tendencies most useful, is the *Apollinaris water*, from the Apollinarisquelle, near Neuenahr, in the Ahr Valley. It contains in 16 ounces $19\frac{1}{2}$ grains of solids, with 9.6 of carbonate of soda, 3.5 chloride of sodium, 2.3 sulphate of soda, and 3.3 of carbonate of magnesia; temperature, 62.6° Fahr. The presence of chloride of sodium and sulphate of soda distinguishes the Apollinaris from the Gieshübel and Geilnau waters, and they are an useful addition. The large amount of carbonic acid is very favourable to its transmission, and allows the water to be heated without entirely losing its refreshing pungency. Having largely recommended the Apollinaris water for several years, we have found it very useful in chronic bronchial catarrh, in tendency to gall-stone, to gout, and to the lithic acid diathesis. This and other highly gaseous alkaline waters form also an useful and agreeable vehicle for some medicines, and a desirable addition to aperient

Apollinaris.

bitter waters; the effect of which is in many cases decidedly increased, thus allowing a diminution of the aperient dose and of its weakening effect.

Heppinger. The *Heppinger Brunn*, likewise in the Ahr valley, is very similar in its constitution, but contains rather less carbonate of soda and carbonic acid.]

Salzbrunn. *Salzbrunn*, Upper Salzbrunn, 1,220 feet above the sea, situated in a woody valley, $1\frac{1}{2}$ hour from the Freiburg station in Silesia, has been known since the beginning of the seventeenth century, though it subsequently fell somewhat into oblivion; since the end of the last century it has been improved as a spa by good establishments and good medical care, and in cases of bronchial catarrh and pulmonary consumption, it has for some time been regarded as the rival of Ems. It has even been called the 'cold Ems.' The celebrity of *Salzbrunn* is historical, inasmuch as it, like Ems, has been the source of clinical experience with regard to the effect of soda-springs, and the Salzbrunn spring shares with others the indications and contra-indications belonging to cold acidulated alkaline waters. As regards its chemical constitution, Salzbrunn contains more bicarbonate of soda and more carbonic acid than Ems, but scarcely any chloride of sodium at all, while this appears at Ems to an amount of 7 or 8 grains in 16 ounces.

Salzbrunn, from its high situation and fresh climate, is suitable for some cases of consumption. This malady has been for some time interdicted at *Ems*, and the reason for this lies partly in a natural reaction after the former misuse of that spa, and partly in the climatic relations of *Ems*; where, in the hot months, the oppressive heat of the valley, combined with the warm spring, is injuriously stimulating to the vascular system of those suffering from tuberculous diseases. A weak soda-water, however, especially when the excess of carbonic acid is removed, is in no wise generally contra-indicated in consumptive complaints; it may, indeed, by alleviating the accompanying bronchial catarrh, be very beneficial, especially when the individual condition does not prohibit the use of a cold spring; and in this, therefore, *Salzbrunn*

has the advantage of *Ems*. An excellent and much frequented whey-establishment is useful in assisting the effect of the springs, and moor-baths have also been recently arranged.

Bicarbonate of soda	. . . .	18 grains
„ lime	. . . .	3.6 „
„ magnesia	. . . .	3.8 „
„ protoxide of iron	. . . .	0.002 „
Chloride of sodium	. . . .	1.3 „
Sulphate of soda	. . . .	4.7 „
Carbonic acid	. . . .	38 cubic in.
Temperature	. . . .	9° C. (48.2° F.)

[*Vals*, in the department of Ardèche in France, about 18 miles from the station Privas on the Lyons-Marseilles line, has very important cold acidulated alkaline springs, which in their composition resemble those of Vichy, but the majority of them, namely, *Magdeleine*, *Précieuse*, *Désirée*, and *Rigolette*, contain more bicarbonate of soda and carbonic acid, and rather more iron; while some are less strongly mineralised, especially *Saint Jean*, and source *Dominique*, which has the reputation of being arsenical. By their large amount of carbonic acid these waters are well adapted for transmission abroad, and are largely and somewhat indiscriminately used in England—at meals and otherwise; but, useful as they are for medicinal purposes by their large amount of bicarbonate of soda, their long-continued dietetic use is often injurious by lowering the sanguification and nutrition.

Evian-les-Bains, near the Lake of Geneva, possesses a very weak alkaline spring, used as well for drinking as for bathing. The climate is mild and refreshing in the earlier and later part of summer, but the heat is great from the middle of July to the middle of August. (Dr. Humbert.)

Soultzmatt, in the Vosges mountains, about 850 feet above sea-level, is a cold alkaline water of medium strength, with a rather large amount of carbonate of magnesia (about 3 grains in 16 ounces), and much carbonic acid. The water is much exported.]

MURIATIC SODA-WATERS.

Muriatic
soda-
waters.

These contain, in addition to bicarbonate of soda and carbonic acid, *chloride of sodium* in perceptible quantities, but no sulphate of soda, or so little that its effect is not apparent.

With regard to their chemical constitution, we may remark that the presence of carbonate of soda is compatible with only a small amount of chloride of sodium in the mineral springs. A water which contains more than about 30 grains of common salt in 16 ounces, rarely possesses carbonate of soda to any amount, and hence we find no carbonate of soda in the real common salt-springs; the soda in them is only combined with the strong acids, hydrochloric and sulphuric, and the only carbonates are those of magnesia, lime, iron, and manganese. A spring in *Luhatschowitz* contains the greatest amount of common salt (33 grains) of all the muriatic alkaline waters; among other well-known springs, *Ems* contains 6 to 7 grains, *Gleichenberg* and *Roisdorf* 3 to 14 grains, *Selters* 17 grains. The springs of *Ems* only are warm, the rest are cold.

Advantage of
muriatic
soda-
waters.

Anticipating the pharmacodynamic character of *common salt*, we will mention the following points, which, as regards this substance, add to the effect of soda-waters. With respect to the solution of the fibrine and albumen in the blood, and therefore its alkalescence, chloride of sodium possesses an importance similar to carbonate of soda, and each probably may take the place of the other. Whilst, however, the increased supply of carbonate of soda only directly accelerates the retrogressive change of substance, chloride of sodium assists the formation of cells and promotes the productive part of the change of substance. Carbonate of soda produces no beneficially stimulating effect upon the stomach and bowels, beyond its influence in removing acidity. None but weaker soda-waters stimulate the activity of the stomach and bowels, and this by means of carbonic acid. Moderate doses of chloride of sodium, however, assist this effect of carbonic acid by increasing the secretion of the mucous membrane

of the stomach and bowels, an effect which only amounts to catarrhal irritation when large doses are taken.

It is evident, therefore, that chloride of sodium is an important corrective, as regards both the local and the general effect of the carbonate of soda, even more than the carbonic acid, and that, for most of the conditions requiring soda-waters, a considerable amount of common salt in them is all the more to be recommended, the greater the amount of carbonate of soda which they contain. To this may be traced, in great part, the pre-eminence which, after years of experience, has been obtained by the waters of Ems and Selters, and even by Roisdorf, above pure soda-waters, and the rapid prosperity of Gleichenberg, and especially of Luhatschowitz. It would be well worth the trouble in cases in which the strong soda-waters of *Vichy* [Vals], *Bilin*, and *Fachingen* have failed in their effect or have manifested bad incidental results, to render them muriatic alkaline waters by a corresponding addition of chloride of sodium. The springs of *Luhatschowitz* form the ideal of a soda-water strong in both these respects. This spa is rapidly flourishing; the clinical experiences obtained there have already established the most important indications for the use of the waters, and artificial manufacturers of mineral waters would do well to imitate these waters for use in serious cases, for producing a more powerful effect than from soda alone.

Instead of enumerating special indications for the use of muriatic alkaline springs, it is sufficient to state, as a *résumé* of the above remarks, that, whenever the consumption of substances is to be stimulated, and at the same time the production of substance assisted, and, moreover, wherever the state of the stomach and bowels requires stimulation of the secretions, soda-waters containing common salt are to be preferred, and this all the more, the stronger the effect of the carbonate of soda required by the general condition and afforded by the water.

Luhatschowitz, in Moravia, $2\frac{1}{2}$ miles from the Hradisch station on the North-Austrian railway, is situated in a pleasant valley of the Carpathians, 1,600 feet above the sea. The springs are cold, but they contain carbonic

Luhats-
chowitz.

acid enough to be warmed without detriment; in their amount of chloride of sodium and carbonate of soda, they are the ideal of strong acidulated muriatic soda-waters, and they establish by experience all the indications for the use of soda-waters in higher degrees of the conditions enumerated, especially in catarrhal conditions and particularly in chronic catarrh of the stomach, in abdominal stasis, and in gouty exudations; and in cases of hyperæmic enlargement of the liver they even come into competition with Carlsbad. The springs for drinking are four in number, and they contain in 16 ounces—

	I.	II.	III.	IV.
	Gr.	Gr.	Gr.	Gr.
Bicarbonate of soda	33	52	61	59
" lime	4.6	4.8	4.9	4.4
" protoxide of iron	0.11	0.13	0.09	0.2
Iodide of sodium	0.13	0.13	0.17	0.18
Bromide of sodium	0.25	0.1	0.07	0.09
Chloride of potassium	1.79	1.59	2.14	1.61
Chloride of sodium	23	25	27	33
	cub. ins.	cub. ins.	cub. ins.	cub. ins.
Carbonic acid	50	29	16	14

(Drs. Kuchler and Galhas.)

Gleichen-
berg.

Gleichenberg, in Styria, seven miles from Graz, 872 feet above the sea, is situated in a pleasant hilly country, with a very mild climate. The Constantius spring is principally drunk, and it contains carbonic acid enough to remain an acidulated water, even after having been heated; it is somewhat richer in carbonate of soda and in chloride of sodium than the springs of Ems, and generally speaking it corresponds with them in the indications for its use, though in a climatic point of view *Gleichenberg* deserves the preference.

Bicarbonate of soda	27 grains
" lime	4 "
" magnesia	4 "
" protoxide of iron	0 "
Chloride of sodium	14 "
Carbonic acid	35 cubic in.
Temperature	17.5° C.

A new spring, the Emma spring, now much used,

possesses the advantage of a far smaller amount of carbonic acid.

Besides these, there is the Klausner spring, a very pure and moderately strong chalybeate, containing 0.66 grains of bicarbonate of iron, and 25 cubic inches of free carbonic acid. (Drs. Clar, Haus, Von Hausen, and others.)

The springs of *Roisdorf* and *Selters* are only used for transmission abroad. Roisdorf,
Selters.

	Selters.	Roisdorf.
Bicarbonate of soda . . .	9.7 grains	9 grains
" lime . . .	2.6 "	2.8 "
" magnesia . . .	2.5 "	4 "
" protoxide of iron. .	0.1 "	0.05 "
Chloride of sodium . . .	17 "	14 "
Carbonic acid . . .	30 cub. in.	19 cub. in.

[The water of *Oberselters*, lately imported into this country, is almost identical with the ordinary natural Selters water, but contains more carbonic acid, and has through this a more refreshing taste.] Ober-
selters.

Ems, in the valley of the Lahn, 291 feet above the sea, Ems. is the oldest and most famous soda-spring. It combines a medium amount of bicarbonate of soda (10 grains) and carbonic acid (19 cubic inches), with a moderate amount of chloride of sodium (7 grains) and very small quantities of bicarbonate of lime and magnesia (1.5 and 1.7). The different springs are only essentially distinguished from each other as regards temperature, Kränchen being 29° (84.2° Fahr.), and Kessel 46° Cent. (114.8° Fahr.).

At the present day, and from all that has been already said as to the effect of soda-waters, no special and specific results are attributed to the *Ems* waters, but only those which belong to them from their average amount of soda, their moderate amount of carbonic acid, their small quantity of common salt, and their temperature; and weaker or stronger soda-springs are preferred according as the circumstances of the case require. The springs of *Ems*, in their natural condition, present an average degree of the strength of soda-waters, adapted to most of the symptoms requiring such waters, and especially a degree suited to most cases

of bronchial and laryngeal catarrh, in which, moreover, the mild and rather damp climate acts beneficially. There are few bathing resorts where a sick person may find in intercourse with nature and man, and in the enjoyment of a brilliant and yet somewhat unpretending spa-life, such rich opportunity both for coming out of himself and for self-reflection; in both respects *Ems* is the pearl of German baths. Consumptive persons, however, ought not to be sent into this valley, as they are exposed by day to a hot and still air, and in the morning and evening frequently to cold mists, especially in the early autumn.

It is scarcely worth the trouble, at the present day, to say a word of the once so famous 'Bubenquelle,' as an universal remedy against sterility. It is nothing but a warm ascending douche.

[In addition to the advantages mentioned, *Ems* has for England the preference of being not so far as many other spas, of having excellent hotels, and English-speaking physicians thoroughly acquainted, from large experience, with the nature of their remedial agents.—Drs. Busch, Danjoy, Döring, Geissé, Grossmann, Vogler, and other physicians.]

In the neighbourhood of *Ems* is the well-arranged cold-water establishment of *Nassau*. (See p. 118.)

Szczawnica, in Galicia, in the Sandecer province, situated 1,050 feet above the sea, in a romantic and sheltered mountain valley, the Polish Upper-Salzbrunn, possesses very good establishments, and transmits abroad a great quantity of water. The springs are cold, very rich in carbonic acid, and considerably richer in carbonate of soda and chloride of sodium than *Ems* and *Gleichenberg*.

*Kainzen-
bad.*

Kainzenbad, near Partenkirchen in Upper Bavaria, which has been recommended for some years on account of its elevated situation and excellent climate (2,400 feet above the sea), may be mentioned here as the representative of very weak soda-springs. The *Kainzenquelle* contains in 16 ounces $6\frac{1}{2}$ grains of fixed component parts, among them 3.7 grains of bicarbonate of soda, and 1.2 grains of barégine, that organic substance which for the present is of interest not to the physician but to the

chemist alone. This amount of soda comes into consideration when the waters are taken internally, but it is irrelevant as regards baths which are to be considered indifferent in their nature; but for both baths and waters, the climate, the excellent arrangements, the height of the situation (4,286 feet above the sea), and the farm of the Eckbauer belonging to the baths, are of importance, and, combined with the sulphurous *Gutiquelle* and the *moor-baths*, render the place excellent for carrying out the thermal system in the case of invalids requiring indulgence. See the notice of Gutiquelle in the remarks on the sulphur-springs.—(Dr. Gruber.)

[*Tönnisstein*, in the Brohl valley near Brohl, on the Rhine, has a cold acidulated alkaline spring, which contains, in addition to carbonate of soda and chloride of sodium, a rather large amount of carbonate of magnesia. The water is sent abroad. The local arrangements are as yet imperfect.]

[*Royat*, in a beautiful situation not far from Clermont-Ferrand, in Puy-de-Dôme, 1,380 feet above sea-level, with an agreeable, refreshing climate, possesses several springs, which in their constitution resemble those of Ems; the temperature of the different springs ranging from 66° to 96° Fahr. The accommodation and bathing arrangements have lately been improved, but they are not equal to those of Ems, while the climate of Royat is, during the months of July and August, decidedly preferable to that of Ems.—Drs. Basset, Boucoumont, and others.]

[*La Bourboule*, likewise in the Auvergne, 2,600 above sea-level, and about four hours' drive from Clermont-Ferrand, has several springs of a temperature ranging from about 54° to 125° Fahr., and of different composition. One of them contains 15 grains of carbonate of soda, with 30 of chloride of sodium, and 4 of carbonate of magnesia; while another contains 10 of carbonate of soda, 21 of chloride of sodium, and 14 of sulphate of soda, and thus somewhat resembles the sources of Carlsbad; in addition, however, all the sources at La Bourboule contain arsenic in appreciable quantities. The importance of these springs, combined with the climatic influences, deserves more general attention.—Drs. Choussy, Danjoy, Peyronnet, etc.]

CHAPTER IV.

AMOUNT OF SULPHATE OF SODA AND SULPHATE OF
MAGNESIA IN WATERS.

As in most bitter-waters, i.e., in those the principal contents of which are sulphate of soda and sulphate of magnesia, a different and sometimes large amount of chloride of sodium is contained, so also many common salt springs contain greater or lesser quantities of sulphate of soda and sulphate of magnesia. In the same manner the latter salts are to be found in about half the known sulphur-springs; here, however, in inconsiderable quantities, of from $\frac{1}{2}$ to 5 grains of each, to 10 grains of both salts together in 16 ounces: they also appear in several chalybeate waters, though not in any great quantity. (*Bocklet*, 2.5 grains of sulphate of soda and 3.2 grains of sulphate of magnesia; *Pyrmont*, 3.5 grains of sulphate of soda and 5.5 grains of sulphate of magnesia; *Driburg*, 6.2 grains of sulphate of soda, and 6.5 grains of sulphate of magnesia.) In stronger but still moderate quantities, though always effective, they form an essential component part of those complicated waters, as *Carlsbad*, *Marienbad*, *Elster*, *Franzensbad*, and *Tarasp*, which we style alkaline-saline waters; and lastly they form, as we have said, the main constituents in the so-called *bitter-waters*.

Physiological effect of sulphate of soda and sulphate of magnesia.

As regards the *physiological importance* of these salts to the blood, and their physiological effect, we know but very little. They are not constituents of the blood, or at least in very small quantities. That as resolvents they take part in the solution of the albumen, is highly improbable, partly because the constant amount of carbonate of soda and chloride of sodium in the blood is sufficient for this, and partly because in a solution of albumen the

coagulation is promoted by sulphate of soda. No chemical effect upon any animal parts has been proved, with the exception of the mucous membrane of the stomach and bowels; the secretion of this they stimulate, producing thin watery secretion, amounting even to severe diarrhœa, containing mucus and albumen. For the slightest degrees of this effect, doses of from $\frac{1}{2}$ to a whole drachm are required, and for greater degrees of it, 1 to 2 ounces. Whilst the small doses do not often disturb the functions of the stomach, larger doses, or the prolonged use of smaller ones, almost always lead to functional disturbance. Dyspepsia and catarrh of the intestines are the usual consequences of aperient doses of Glauber's salt and Epsom salts, and they are connected with that irritating effect on the mucous membrane by means of which they produce diarrhœa. Liebig's theory, according to which the aperient effect ought to proceed from increased exosmosis, has been refuted by others: the salts only act as stimulants, and pass for the most part into the fæces, to be evacuated with them; they are only absorbed in smaller doses and pass away with the urine, and the greater the absorption the less is the aperient effect. In the intestinal canal itself a portion of them is decomposed into sulphuret of sodium and sulphuretted hydrogen; there is, however, an utter lack of observations which may allow us even approximately to conjecture the amount of this decomposition and of the possible effect of the sulphuretted hydrogen thus produced.

This is about all that we know with regard to the physiological effect of these salts; and accordingly their therapeutic appreciation is likewise scanty, and is limited to the consequences of the aperient effect. They are either used as a momentary aperient remedy, like other mineral and vegetable aperients; or the less irritating effect of smaller doses is used, in order, from repeated milder effects, to obtain a total which also essentially is increased intestinal secretion, though at the same time sparing the stomach and not causing any catarrhal irritation of the bowels. With regard to Seegen's experiments as to the diminished secretion of nitrogen, we refer the reader to

the section upon the general effect of Glauber's salt-springs. If the observations of Radziejewsky are confirmed, according to which all aperient remedies, and the sulphates among others, only produce an effect by increasing peristaltic action, we must conceive the increased excretion otherwise than we have hitherto done—not as an artificial transudation of the bowels. But the normal and physiological transudation would be more rapidly removed, and thus indirectly the increased secretion of the bowels would be caused. An increase of the secretion would, however, always take place.

An aperient dose of *bitter-water* is nothing else than the solution of an aperient dose of Glauber's or Epsom salts in water; and it does not belong to our compendium of Balneotherapy to show under what circumstances such a laxative is indicated and is to be preferred to others. Regular courses of waters with aperient doses of *bitter-waters* have recently and justly become much more rare than formerly. The intended stimulation of the sluggish mucous membrane of the bowels almost always passes beyond its mark, and sluggishness of the bowels is changed into catarrh of the bowels, from which the mucous membrane relapses into an increased sluggishness, leaving the general health and the nutrition impaired. We have above (page 308), from manifold experience, mentioned cold acidulated waters as the remedy which in these cases very often attains the object permanently and without injury.

Smaller doses of salts in prolonged use are now recommended for the second kind of treatment, in order to secure some sphere of work for these waters. They occasionally achieve their object, but in most cases injurious results occur, especially as regards the stomach; practical necessity has therefore long ago led to the habit of impregnating these waters with gas or mixing them with acidulated waters, and thus adding the *carbonic acid* as an adjunct and corrective: as an adjunct, because from its presence smaller doses of salts are sufficient to produce effect; and as a corrective, because it beneficially stimulates the stomach which is easily burdened with the salts. We must observe that the irritating effect on the mucous membrane caused by sulphate of magnesia (Epsom salt) is

about $1\frac{1}{2}$ times as strong as that by sulphate of soda (Glauber's salt). From the above remarks, it is not to be wondered at if, for producing the effect of smaller doses of Glauber's salts, those complicated waters have gained the preference which contain in addition to *Glauber's salts*, *carbonate of soda*, *chloride of sodium*, *carbonic acid*, and in some instances even *iron*, and the general effect and appreciation of which originate with experiences of *Carlsbad*. We shall therefore satisfy ourselves with stating the analyses of the better known *bitter-waters*; and for detailed indications of *Glauber's salt-waters*, we shall limit ourselves to the appreciation of the alkaline-saline springs.

The *Friedrichshall water*, with its moderate amount of Glauber's and Epsom salts and its medium amount of chloride of sodium, is an excellent empirical combination for slightly stimulating the change of substance, especially when taken in small and not aperient doses; and the use of it is therefore indicated in many individual cases, which are allied to conditions adapted to Carlsbad, Marienbad, Tarasp, Kissingen, and Homburg.

The Hungarian bitter-waters are similar in quality to the Friedrichshall, but their amount of sulphates is larger and of chloride of sodium smaller; the former from 70 to 230 grains, and the latter from 11 to 21.

[The *Hunyadi Janos* waters are, in fact, the richest bitter-waters we know. Sixteen ounces contain 300 grains of solid substance, including 138 of Epsom salts and 129 of Glauber's salts, with 11 of chloride of sodium and 13 of carbonate of soda, while most other bitter-waters do not contain any carbonate of soda. We have found these waters very useful, where simple saline aperients were required.]

	Püllna.	Sedlitz.	Saidschütz.	Friedrichs- hall.
Sulphate of soda . . .	123.8	0	46	46
„ potash . . .	4.8	0	4	1.5
„ lime . . .	2.6	8	10	10
„ magnesia . . .	93	104	84	39
Nitrate of magnesia . .	0	0	25	0
Chloride of sodium . .	16	3	2	61
„ magnesium . . .	—	—	—	30
Carbonate of magnesia .	6.4	3	5	0
Carbonic acid . . .	Cub. in. 6.9	Cub. in. 0	Cub. in. 0	Cub. in. 9

There are many other bitter-waters in more or less general or restricted use, and it seems that the slight differences in their composition render the one or the other much more suitable to certain constitutions than all the rest. In most cases, however, this is not so much to be inferred from the figures of the analysis as from individual experience or the trial of different waters.

The once famous *Epsom* well, from which its principal solid constituent, sulphate of magnesia, has obtained its popular name, contains in the pint 240 grains of Epsom salt. *Birmensdorf*, in the Canton Zurich, much liked by many people, contains 54 of sulphate of soda, 169 of sulphate of magnesia. The bitter-waters of *Kissingen* (p. 401) and *Mergentheim* (p. 404) have in the same way their admirers. The *Streatham* well, which as late as 20 years ago was much sold in London in large pitchers containing 3 or 4 quarts, contains about 55 of sulphate of magnesia with a small quantity of other salts; the *Beulah* Spa, near Norwood, with 61 of sulphate of magnesia, 9 of sulphate of soda, and some common salt, is even now occasionally used; while the *Kilburn*, the *Cherry Rock*, the *Victoria Spa*, and many similar weak bitter-waters in England, have been almost entirely forgotten.

Purton
Spa.

The *Purton Spa*, near Swindon Junction, has of late been re-opened, according to Dr. Macpherson's account, and will no doubt prove useful in many cases, if methodically used under medical guidance and with a proper régime. It contains 23 grains of sulphates of soda and magnesia (together), with 10 grains of sulphate of lime, 3.6 of carbonate of potash, and 4.2 of chloride of sodium, and is impregnated with 6 cubic inches of carbonic acid, in which most English and also most foreign bitter-waters are defective. The mild aperient effect is, however, somewhat counteracted by the large proportion of gypsum.

Cheltenham.

In following Dr. Macpherson's account of English spas, we may here also mention *Cheltenham*, although the large amount of common salt in one of the principal springs (No. 4, Montpellier), viz., 52 grains in the pint, would also justify us in placing it among the common

salt waters. The sulphates consist of 17·2 grains of sulphate of soda, and 14·2 of sulphate of magnesia. The constitution of Pitville saline water is similar, though not identical. The principal defects of these waters are the small proportion of carbonate of soda and carbonic acid; but these might be remedied by the addition to every tumbler of a certain quantity of Bilin or Fachingen or Vals water, and the temperature might be regulated according to the individual cases. If this suggestion were followed, and if at the same time some able local physicians would devote themselves more thoroughly to the methodic administration of the waters, and to the regulation of diet and exercise according to the requirements the different cases, we can see no reason why not *Cheltenham* and also *Leamington* should again become much-frequented and useful watering-places, the more so as in many instances they could be resorted to also in early autumn and even winter, on account of their greater mildness of climate compared with continental spas. *Cheltenham* possesses also a rather strong chalybeate with 0·88 grains of carbonate of potoxide of iron, 6 grains of other salts, and an amount of carbonic acid sufficient for use at the well, though not for transmission.

The climate may be regarded as healthy, the average annual death-rate being about 19 per 1,000. The summer temperature is stated by Dr. Macpherson as two degrees cooler, the winter temperature as three degrees warmer than that of London. The accommodation at *Cheltenham* as regards furnished private houses, apartments and hotels, is good.

Leamington may likewise be classed with the mixed sulphated waters with about the same right as with muriated. These cold springs contain no sulphate of magnesia but only of soda, ranging from 28 to 40 grains per pint in the different springs. The *saline* spring contains, in addition to 40 grains of sulphate of soda, 40 of common salt, 20 of chloride of calcium, 3 of chloride of magnesium, with traces of iron, bromine, and iodine, and 2 cubic inches of carbonic acid. The *saline chalybeate* contains only 32 grains of sulphate of soda, with

Leamington.

over 60 of chloride of sodium, 20 of chloride of calcium and 12 of chloride of magnesium, about a whole grain of iron, and 3 cubic inches of carbonic acid. There are, besides, a *sulphuretted*, saline, and several other springs. The usual season extends from May till October. The advantages of the springs for some cases are apparent, and the defects for others might be remedied, like those at Cheltenham, by warming the water and adding certain proportions of foreign, especially acidulated alkaline, waters.

Scar-
borough.

The *North Well* and *South Well* at Scarborough are likewise to be regarded as weak bitter-water, with, however, a rather too large amount of lime-salts for cases requiring purgative waters. The *South Well* contains 28 grains of sulphate of magnesia, 13·8 of sulphate and 6·0 of carbonate of lime, with 3·7 of common salt and 0·23 iron. The *North Well* contains only 17·8 of sulphate of magnesia, but is otherwise similar.]

SODA-WATERS CONTAINING SULPHATE OF SODA.

As we have said, for producing the mild effect of sulphate of soda and for courses of drinking, those complicated waters are now generally preferred which, in addition to this salt, contain also carbonate of soda, chloride of sodium, and carbonic acid, and the principal representatives of which are *Marienbad*, *Carlsbad*, and *Tarasps*. Others, such as *Füred*, *Bertrich*, *Rohitsch*, and *Stubnya*, belong to the same class, it is true, as regards their qualitative composition, but the quantity of their active ingredients is so small that they cannot be compared with the former. The springs also of *Franzensbad* and *Elster* so far belong to this category as the amount of iron which characterises them is somewhat small, and as a similar proportion is present also in the *Marienbad* springs. Of all these springs, only those of *Carlsbad*, *Stubnya*, and *Bertrich* are warm; the rest are cold; but these contain, like the simple cold soda-waters, such a plentiful quantity of free carbonic acid that they can be warmed for drinking without damage. The use of these waters, and the clinical observation of their effect, have emanated from *Carlsbad* and subsequently from *Marienbad*; and these two spas are

even at the present day the central point of interest for all practical and theoretic questions.

Analytical Table, omitting Minimal Component Parts.

	Marienbad.		Carlsbad.		Tarasp.		Franzensbad.		Elster.		Rohitsch.	Füred.	Bertrich.	Stubnya.
Sulphate of soda	36	38	18	17	16	17	25	22	24	15	6	7	4	
Chloride of sodium	11	15	8	7	29	9	9	14	8	—	—	3	—	
Carbonate of soda	9	10	10	9	27	7	8	4	4	6	—	1·4	—	
Carbonate of lime	4	4	2	2	12	1	1	1	1	11	6	—	3	
Carbonate of magnesia	3	3	1	1	5	—	1	1	—	9	—	—	—	
Carbonate of protoxide of iron	0·3	0·47	0·02	0·02	0·15	0·01	0·2	0·3	0·8	0·06	0·08	—	—	
Carbonic acid in cub. in.	15	22	7	17	33	26	31	28	16	25	38	4	3	
Temperature in Cent.	10	10	74	51	6	10	11	10	10	11	12·5	32	44	
Temperature in Fahr.	50	50	165	124	42·8	50	51·8	50	50	51·8	54·5	89·6	111·2	

While, as regards the waters of *Marienbad*, *Carlsbad*, *Tarasp*, *Franzensbad*, and *Elster*, we may mention the effective doses of Glauber's salt taken daily by drachms, very considerable quantities of water must be drunk of the last three springs of the above table, and the stomach must be overloaded in order to produce any effect from the Glauber's salts. *Rohitsch* may, it is true, be regarded as a Glauber's salt-spring, but the others, *Bertrich* and *Stubnya*, are nothing more than indifferent thermæ with a very small amount of carbonic acid and without iron. *Füred* alone may be considered a tolerably pure chalybeate.

The character of the effect of soda-springs containing sulphate of soda is proved from the old-established clinical treatment pursued at *Carlsbad* and *Marienbad*, to be the following: the cure and improvement of all the conditions in which these springs are found to be efficacious, is almost always accompanied with various degrees of emaciation from loss of fat, without the participation of the muscles in this emaciation, and without the appetite, digestion, assimilation, and general health becoming depressed. The last-mentioned injurious consequences only occur, as a rule, in the case of extreme treatment with

General effect of Glauber's salt-springs.

strongly aperient quantities of the water, and in milder though effective treatment they rarely appear. The *diminution of fat* is, therefore, an almost constant effect produced by these waters, and for the present the starting-point for their appreciation.

The cause of the diminution of fat seems indirectly to lie in the increased consumption of protein-matter. Albuminous secretions from the intestinal membrane, caused by the local effect of Glauber's salt, and assisted by the effect of the carbonate of soda and chloride of sodium on the blood, produce the increased consumption of protein-matter; a fact confirmed, it is true, by daily experience, but which, in a manner of its own unknown to us, is compensated for in the absorption and consumption of the fat deposited in the tissues. Accurate experiments on the matter have been commenced by Professor Seegen at Carlsbad, and their main result consists in the fact that with the use of Glauber's salt and the Carlsbad thermæ the elimination of nitrogenous matter through the kidneys is very considerably diminished. This experience admits, however, of no inference as to the general effect, so long as no investigation of the fæces has yielded information respecting the evacuation of albumen in this way. Albumen is often found in diarrhoeal secretions, although but rarely quantitatively determined. Increased mucous secretion is likewise always accompanied with an increased loss of nitrogen, as not only is the mucine a nitrogenous substance, but in the catarrhal mucus of all mucous membranes albumen is almost always found. Moreover, in catarrhs the amount of fat in the mucus is also increased. For these reasons we must for the present consider the diminution of nitrogen in the urine as a counter-effect, caused by the increased loss of azote through the bowels. While Seegen maintains his point, on the other hand, because the diminution of azote in the urine does not always coincide with great evacuations from the bowels, his reasoning does not hold good, for the excretion of the fæces in no wise always coincides with the secretion of the bowels, especially when smaller and slowly-operating doses of Glauber's salts are taken.

It is, moreover, striking that the effect produced by Glauber's salt in the waters in question is connected with small doses, with doses of one or several drachms at the most, whilst half and whole ounces per diem of pure Glauber's salt are required; and we are therefore inclined to seek for the stronger effect in those component parts which are added to the Glauber's salt, namely, in the carbonate of soda as a dissolvent of the albumen in the blood, in the chloride of sodium as a gentle stimulant of the intestinal membrane and as a promoter of the change of substance, and in carbonic acid as a stimulant of the mucous membrane and muscles of the intestines. And we are equally inclined to suppose that these elements not only increase but also correct the action of the Glauber's salt, as they allow of smaller doses of this salt being taken, and also counteract its injurious local effect. The carbonic acid does this by stimulating the stomach, and the chloride of sodium by its conservative participation in the formation of cells and by stimulating the digestion. For the gentle and yet prompt effect, however, of Glauber's salt upon the albuminous secretion of the bowels, carbonate of soda is perhaps the most necessary condition. By its dissolvent effect upon the albumen of the blood, it can *dispose* the latter to serous transudation, and thus prepare the way for the effect of smaller doses of Glauber's salt, a matter which larger doses only obtain by force and at the expense of the catarrhally irritated intestinal membrane.

Carbonic acid, chloride of sodium, and carbonate of soda in Glauber's salt-springs.

EXAMINATION OF CURRENT CLASSES OF CASES.

1. *Corpulence*, in its various significations, either as a symptom or as the cause of other conditions, finds in Glauber's salt waters a tolerably certain and gentle remedy, in the use of which, with careful treatment, the object may be obtained without violent evacuation and without dyspeptic injury to the stomach. We must not, it is true, forget that in most cases only a certain amount of diminution of fat is aimed at, and that, after the cessation of the treatment, the formation of fat very easily increases again, if a strict diet be not observed. If at the same time any tendency to hyperæmia of the head or lungs

Corpulence.

exist, or if the corpulence be accompanied with feebleness of the heart, especially with fatty heart, the alternative between cold gaseous and warm non-gaseous springs comes into question, especially between Marienbad and Carlsbad. The former may injuriously stimulate from its strong amount of carbonic acid, the latter from its heat. Both of these influences may be prevented; the warmth of the Carlsbad water may be tempered by cooling; the otherwise not excessive amount of carbonic acid in the Marienbad water may be diminished by repeatedly pouring it from one glass into another. The springs of Tarasp have a very considerable amount of gas, but this is perhaps less serious, because at an elevation of more than 4,000 feet the gas more easily escapes. If, however, the corpulent organism afford more resistance to the effect of the Glauber's salt on the bowels, or if altogether greater secretion from the bowels be required, either the Marienbad water, which is stronger in Glauber's salt, is to be preferred, or Carlsbad salt (consisting of sulphate of soda, chloride of sodium, and carbonate of soda) is to be added to the Carlsbad water. Such an addition is more rarely required for Tarasp, because the great amount of common salt (29 grains) and of carbonate of soda (27 grains) considerably increases the effect of the Glauber's salt.

Diabetes.

2. *Diabetes*.—We will only here add to the remarks already made (p. 338) upon this disease, that the alternative, which is based upon experience, between *Vichy*, a pure soda-water, and *Carlsbad*, a saline-muriatic soda-water, necessarily points to the carbonate of soda as the effective agent; and that in the weak soda-water of Carlsbad the amount of the two other salts contained in it probably acts as an assistance in rendering the effect equal to that of the very strong soda-water of Vichy. At any rate, other strong soda-waters, such as Bilin and Fachingen, may be tried with a similar prospect to Vichy, and a trial of Tarasp may also be made in cases of diabetes. Tarasp resembles Carlsbad with respect to its amount of Glauber's salt, but it surpasses it threefold in its amount of chloride of sodium and carbonate of soda; and moreover it would be desirable to ascertain what advantage at the

same time may be afforded by the mountain-air, at an elevation of 4,000 feet above the sea.

3. *Liver-Diseases*.—In these diseases, besides the lixiviating and absorption-promoting effect upon the blood, the indirect stimulation of the functions of the liver is required, and in many cases the diminution of fat and the free circulation in the abdomen are of essential value. Simple hyperæmic enlargement of the liver after intermittent fever, or as a symptom of general plethora abdominalis, are the more favourable cases, and these are often cured and improved by the use of the mineral waters in question. If, however, the hyperæmia consist in an extension of the capillaries in consequence of hypertrophy of the heart, or of pulmonary phthisis [nutmeg liver, fatty liver], the prognosis is altogether bad, and the use of the springs is, as a rule, contra-indicated. Really chronic inflammation of the liver generally terminates fatally, and we do not believe that other than antiphlogistic remedies are allowable. Cirrhosis of the liver or inflammation of the interstitial tissue is, in its second stage, past all treatment, and in the first stage antiphlogistic remedies are not to be dispensed with; only when the state of the digestion and the strength allows it, Glauber's salt waters and weaker common salt waters may in the first stage be tried, and they are occasionally accompanied with successful results; the same may be said also of lardaceous liver. *Gall-stones* are often passed during the use of alkaline waters, especially at Carlsbad; whether from a chemical effect or from increased secretion of bile, is quite uncertain; and frequently the sufferers remain for years free from attacks. *Catarrhal icterus* generally terminates in recovery even after expectative treatment; and no case has come before us in which the use of an alkaline water has distinctly accelerated recovery. These, however, in a prophylactic point of view, may always be tried, and especially Carlsbad and Marienbad; but the treatment must be moderate and must not be lowering to the nutrition.

In *competition* with the soda-waters containing Glauber's salt for all cases of liver-disease, are the weaker but gaseous *common salt-springs* and a few sulphur-springs,

Liver-diseases.

Competition with common salt waters

and Weil-
bach.

especially *Weilbach*. We will here only briefly remark that common salt produces a two-fold effect; partly by stimulating both the retrogressive and progressive change of substance, and partly by indirectly stimulating the liver; and that sulphur-waters probably, according to Roth's theory, produce an effect by destroying the worn out or old blood-corpuscles in the portal vein, without any real loss of fat and albumen; hence *Weilbach*, in cases of persons of delicate lungs, suffering from fatness of the liver, and in hæmorrhoidal hyperæmia of the liver, is of great benefit, and is well borne, while Carlsbad and similar waters are generally contra-indicated by these complications.

Plethora
abdomin-
alis.

4. *Hæmorrhoidal conditions*, plethora of the abdomen, and *hypochondriasis*.—No set form of rules can guide the unpractised physician through the labyrinth of all the different conditions and requirements which are presented to medical attention by the above terms. Practice at the sick-bed alone can throw light on the complication they afford, at any rate as regards practical maxims of prognosis and treatment; and with respect to local symptoms, the mechanical conditions of the circulation of the blood, to which Virchow has attached much importance, must above all guide our considerations. Personal experience, aided by that of others, has led the author to take a general point of view, which may, perhaps, be of greater use to the beginner than a variety of formal distinctions, and which we shall therefore repeat here from our pamphlet upon *Rehme*.

There are, in the first place, two opposite groups into which the greater number of cases, with their essential diversities and essential accordances, may be divided:; namely the type of the *corpulent* hæmorrhoidal subject, and the type of the *thin* hæmorrhoidal subject.

Type of
corpulent
hæmorrhoi-
dal subject.

In the former, in opposition to a wide-spread traditional opinion, the formation of fat, generally speaking, is not effected at the expense of the muscular substance and other tissues, but the nutrition is in general good, the appetite and digestive powers are excellent, and even the action of the bowels is usually not retarded. The strength of the body is not diminished, but its movements are only somewhat impeded either by the mechanical hin-

drance of weight, and the awkwardness of the unnaturally large limbs, or by the disturbed action of the fat-covered heart. Gravel and gout are frequent accompaniments; the latter is often the fundamental nature of the condition. Spontaneous or artificial hemorrhoidal bleedings relieve it, and aperient and emaciating methods of treatment are all the more indicated, as the accompanying disease of the liver for the most part consists of fatness of the organ or hyperæmic enlargement; and dyspepsia and catarrh of the stomach only appear in very rare cases. Such patients are the legitimate visitors at Carlsbad, Marienbad, Kissingen, Homburg, &c. Aperient and emaciating methods of treatment suit them well, and their generally cheerful temperament and social character find in these much-frequented places the food they require in order to aid the treatment also in this point of view.

A wholly different appearance, however, is afforded by the type of the *thin hemorrhoidal subject*. The cause here is generally a sedentary mode of life, mental effort at the expense of the body. The beginning of the disease is frequently dyspepsia and catarrh of the stomach. The affection of the liver has often rather the character of atrophy, with occasionally a tendency to diabetes. The stomach and bowels are badly nourished, the digestion and motion of the bowels are for the most part very sluggish, the disposition of mind is gloomy, and the poverty of the blood is extreme, though often, indeed, concealed from superficial observation by a jaundiced colour. Bleedings do not act salutarily, but aggravate the nature of the condition. The skin, like the whole body, is feebly nourished, and cannot protect the frame from the influences of temperature; and nothing is so much to be prohibited as aperient courses of treatment. It is true that many cases, standing midway between the two types, may be reckoned as belonging to this group; cases in which the careful use of reducing remedies temporarily employed may prove an assistance in the cure; but in the more marked cases of this type it is not only permitted, but it is distinctly enjoined, to be satisfied with the general remedies for promoting nutrition, namely, country life, either by the sea or in moun-

Type of
thin he-
morrhoidal
subject.

tainous districts, travel, stimulating baths at less frequented spas, where the gloomy temperament is not exposed to the mental contagion of the ills of others. These are remedies which by frequent repetition attain their object, and which in many cases are beneficially assisted by a moderate use of iron, and even of fat and cod-liver-oil. These are the sufferers for whom the old Stahl mixed his pills of aloes and iron, and who even at the present day feel themselves better with pills of aloes and nux vomica than with the laxative waters of Marienbad, Kissingen, Homburg, or other places.

Catarrh of
respiratory
membrane.

5. *Conditions adapted for Glauber's salt waters as well as for simple and muriatic soda-waters*, are those of gout, gravel, catarrh of the bladder, catarrh of the stomach and bowels, and scrofulous glandular swellings. For *catarrh of the respiratory mucous membrane*, the Glauber's salt waters of Marienbad and Carlsbad seem to be less tested and less frequently used than the simple and muriatic soda-waters, because they contain far less soda than the latter; and it is only when great stasis of the abdomen appears as a complicating condition that they should be used instead of the others; on the other hand, the strong soda-spring of Tarasp numbers bronchial catarrh among the indications adapted for its use.

Catarrh
of the
bladder.

In cases of *catarrh of the bladder* an effect is produced by strong soda-waters, such as Vichy, Bilin, Fachingen, Luhatschowitz, of a decidedly more powerful and rapid character than by Carlsbad and Marienbad; and it is only in extreme cases of stasis in the portal system that the latter, and then only temporarily, are to be preferred.

Gout and
gravel.

The case is different with *gout and gravel* (pp. 73, 74). In these diseases, Carlsbad, Marienbad, and Tarasp, produce an undoubtedly quicker and more powerful effect not merely on the dyscrasia of the blood, but also in diminishing exudations; the stimulation of the retrogressive change of substance being far more considerable with these waters than with simple soda-waters. Rarely is gouty dyscrasia cured or even essentially diminished; still the best and most reliable results date from Marienbad and Carlsbad, and recently from Tarasp.

Catarrh

Catarrh of the stomach and bowels is likewise often

treated at Marienbad and especially at Carlsbad. As far as our own experience goes, none but slight cases and very gentle treatment hold out the prospect of a successful result.

Chronic ulcers in the stomach are, as is well known, very often healed by a consistent dietetic treatment, combined with careful attention to the symptoms and with the aid of astringent remedies, among which nitrate of silver and acetate of lead are the most effective. Very many different mineral waters are of course used, and famed as remedies for such a frequent disease; but the supposed result often proceeds from a misunderstanding: either it is overlooked that this, like every other curable malady, *bears* various treatment, which according to the nature of disease and remedy ought to do harm, and for the most part also really does harm; or the complications and consequences accompanying it are improved by medicinal waters, such as the anæmia by iron, the sluggishness of the bowels by common salt, and the like. Generally speaking, we consider common salt waters as contra-indicated, and weak soda-waters as the most suitable, but we cannot deny that we also know many cases which have been improved and cured by the use of moderate courses of Carlsbad waters. In common with strong soda-waters, strong Glauber's salt waters are also prohibited, and the average quantity of the amount contained in the Carlsbad water is about the limit of what is allowable. An excessive amount of carbonic acid also acts as an injurious stimulant. The temperature, on the other hand, may be regulated according to individual circumstances, and especially according to the greater or lesser inclination to bleedings.

In *Scrofulous exudations* we have already on a former occasion recommended Carlsbad from personal experience; and Tarasp, which is far stronger in common salt and soda, possesses likewise a great reputation. The opinion of physicians is more in favour of common salt waters; but Carlsbad produces the same effect generally without that catarrhal irritation of the mucous membrane of the bowels which is the frequent consequence of energetic common salt courses, and it is especially to be recommended in the cases of persons requiring delicate management.

of the
stomach
and
bowels.

Ulcers
in the
stomach.

Scrofulous
exuda-
tions.

In the above remarks on the physiological effect and the indications suitable, we have directed due attention to the differences existing between the different springs, and to their respective advantages, so that we have now only to state their local circumstances. In Franzensbad and Elster the amount of iron has to be taken into account; this, however, is equally considerable in Marienbad, but, as we shall have occasion to mention under the head Steel Waters, the effect of iron is all the more questionable the more that it is accompanied by chlorides and sulphates in the waters, and thus more easily discharged by the bowels.

Carlsbad.

Carlsbad in Bohemia, about 1,200 feet above the sea, situated in a narrow valley, with a somewhat rough climate, is a spa of the first rank, and is one of the oldest German bathing resorts. It possesses one great advantage in the fact that, in very many houses, the food supplied is prepared in accordance with the treatment; a disadvantage is the excessive use of strong coffee, induced by the lassitude attending the increased exercise and by the excellent way in which the beverage is prepared. For the use of the springs, see the above examination of the indications. The valley is very rich in warm springs, which differ but little in the amount of salt they contain, though greatly in their temperature and amount of carbonic acid. The best known are the Sprudel, the Mühlbrunnen, and the Schlossbrunnen, in the analysis of which we omit the minimal component parts as unimportant, with the exception of the iron. They contain (grains per 16 ounces):

	Sprudel.	Mühlbrunnen.	Schlossbrunnen.
Sulphate of soda . .	18.21	17.96	17.24
„ potash . .	1.26	1.71	1.46
Chloride of sodium . .	7.91	7.89	7.52
Carbonate of soda . .	10.45	10.86	9.66
„ lime . .	2.28	2.02	3.06
„ magnesia . .	0.95	0.26	0.38
„ protoxide of iron . . }	0.02	0.02	0.01
Carbonic acid . .	11.8 (cub. in.)	14.8 (cub. in.)	20.6 (cub. in.)
Temperature . .	74° Cent. (164.2° F.)	52° Cent. (125.6° F.)	51.5° Cent. (124.7° F.)

As the different springs present but very slight differ-

ences in their fixed component parts, and the amount of iron in none of them exceeds a minimal quantity, the choice of them is regulated only by temperature and by the amount of carbonic acid; and in this respect it is worthy of remark that the warmest spring, the Sprudel, contains the least carbonic acid. The daily doses vary, and increase gradually from 2 to 10 glasses, containing from 4 to 6 ounces, and the direct effect may not in most cases exceed more than a few fluid evacuations. Wherever, and this is rarely the case, real diarrhœa is intended to be produced, either the cold Marienbad water is taken, or Glauber's salt is added to the Carlsbad spring; perhaps in the form of the Carlsbad salt, in order not to overload the stomach with great quantities of warm water and heat the blood.

The baths at Carlsbad are, as regards their small amount of chlorine, indifferent thermæ, the effect of which is somewhat strengthened by carbonic acid. As, however, in the above numbers of 11·14, and 20 cubic inches of gas, the free and half-combined carbonic acid of the bicarbonates is included, these figures must be reduced, in estimating the effect of the baths, to 7·7, and 17 cubic inches.

[As Carlsbad is with every year more recognised as particularly suitable to combat many of the complaints caused by the manner of living prevalent in England, and especially in London; as it seems, to use the words of a witty statesman, 'made for the English,' I venture to give a short statement regarding my experience with Carlsbad waters in some of the more frequent morbid conditions treated by them. These results almost entirely agree with the views expressed by Dr. Seegen, of Carlsbad, in his *Heilquellenlehre*.¹

I have seen much benefit—

1. In *gastralgia*, or pain in the region of the stomach, occurring principally after meals, and especially when connected with flatulency.

2. In *catarrhal states of the mucous membrane of the stomach and intestines*, often accompanied in the

¹ 2nd edit., pp. 360 to 369.

former by constipation and by vomiting, especially in the morning; in the latter by diarrhœa, or diarrhœa alternating with constipation.

3. In tendency to *gall-stones* and *allied conditions of bile*. It must be acknowledged that in some cases the attacks of gall-stones have occurred again and again after one and even after several courses of Carlsbad; but in many cases under my observation there have been, after a course at Carlsbad, no attacks, or only rare and milder ones, while before the use of Carlsbad for years scarcely a month had passed without an attack. In one instance a lady had suffered for many years, in spite of other remedies, under usual and homœopathic treatment, in such a manner that malignant disease was suspected. For the last twelve months, before the course of Carlsbad, she had scarcely a day without one or several attacks; from having been a well-nourished and fair woman, she had become emaciated to an incredible degree, had been jaundiced all the time, was incessantly troubled with intolerable itching of the whole skin, had a marked swelling of the liver, and was so weak that my advice to go to Carlsbad was received by her friends as most hazardous, on account of the journey and the supposed violent action of the waters. She went, however, and found entire relief at the end of a double course of six weeks each, separated by a month of rest; she afterwards rapidly regained her general health, and has for years only had a few slight attacks.

4. In *enlargement of the liver and spleen*, as the effect of malarious fevers, especially when attended with constipation.

5. In passive *hyperæmia of the liver*, from sluggish circulation in the portal system, from habitual constipation, over-feeding, and insufficient exercise; also in hyperæmia of other abdominal organs, caused by sluggish venous circulation.

6. In tendency to *uric acid concretions* and the *catarrhal condition* of the urinary organs often attending this tendency. In these cases I have found Carlsbad, in spite of the small amount of soda, at least quite as useful as the strong alkaline waters.

7. In *gout* and *gouty conditions*, without considerable

enlargement of the joints, especially in individuals with sluggish abdominal circulation, with tendency to lithates and to atheromatous changes of the arteries, but not in advanced atheromatous degeneration.

8. In *diabetes* I have always seen improvement, or temporary cure; and, though I cannot speak of permanent cures, the Carlsbad waters ought to take a high rank in the therapeutical management of this disease if not too far advanced.

I must add a few words regarding the popular error that a course of Carlsbad waters is always a 'violent measure.' It might, on the contrary, be maintained that, where such a course is judiciously planned and well managed, it is the mildest measure which can be adopted amongst the different *effective* plans of treatment which can be taken into consideration. The pretty general belief that purging, and lowering, and starving are required is quite erroneous; it is even almost always a serious mistake to push the waters to produce diarrhœa; but a restricted, though nourishing diet, moderate but not fatiguing exercise, mental quietude, and rest after the termination of the course, are essential. It is not to be wondered if a course of Carlsbad proves injurious under the following circumstances, which constantly occur, with numerous variations. A man works hard up to the last moment before leaving London; ill as he is, to save time, he travels, in the heat of summer, in two or three days, the long distance to Carlsbad; in spite of his fatigued state, he begins his course at once, pushes it on, drinks often one or two glasses more than the doctor tells him, 'because there is not sufficient effect,' and 'because he must make the most of his time'; he then hastens back, as fast as he came, 'for his partner leaves for his holiday,' and on arriving in town the 'renewed man' wants to do the work of two or three, but he finds it very difficult, and 'Carlsbad was a mistake.']

[Drs. Anger, Gans, Fleckles, Hlawaeek, Hochberger, Hofmann, Kraus, Preis, Seegen, Zimmer, and other physicians.]

Marienbad, likewise in Bohemia, 1,912 feet above the sea, is situated in a beautiful wooded broad valley, and is the principal representative of the cold and gaseous

*Marien-
bad.*

Glauber's salt waters. The springs most used, the Kreuzbrunnen and the Ferdinandsbrunnen, are stronger, both in Glauber's salt as well as in other salts, than the Carlsbad springs, and they contain far more free carbonic acid than these (15 and 22 cubic inches). This larger amount of carbonic acid may have a share in the more strongly aperient effect, though this is no doubt chiefly to be traced to the greater amount of Glauber's salt. In general, therefore, smaller quantities are taken at Marienbad than at Carlsbad, or those persons especially are treated there in whom a greater secretion of the bowels is required. In other points the conditions adapted for both spas are about the same, with the general difference just mentioned, and with the distinction also that diabetes seems to be excluded from Marienbad. The Kreuzbrunnen contains 0·27 grains of carbonate of protoxide of iron, and the Ferdinandsbrunnen 0·47 grains; therefore the quantity of iron exceeds even that found in some pure steel waters. We do not, however, believe in any considerable effect from iron in aperient sulphated waters, because the iron in these is quickly ejected as sulphuret of iron; on the other hand, in a pure acidulated chalybeate, such as the Kronprinz-Rudolfsquelle, recently analysed by Lerch, and which has great similarity to Wildungen water, the iron is certainly of great importance.

	Kreuzbrunnen.	Ferdinandsbrunnen.	Kronprinz-Rudolfsquelle.
Sulphate of soda . . .	38·04	38·76	0·81
" potash . . .	0·4	0·5	0·17
Chloride of sodium . . .	13·06	15·39	0·45
Carbonate of soda . . .	9·02	9·89	1·06
" lime . . .	3·99	4·3	8·57
" magnesia . . .	3·33	4·2	5·14
" protoxide of iron . . .	0·27	0·47	0·32
Free carbonic acid . . .	15 (cub. in.)	22 (cub. in.)	16 (cub. in.)
Temperature . . .	9° Cent. (48·2° Fahr.)	9° Cent. (48·2° Fahr.)	9° Cent. (48·2° Fahr.)

Other springs, such as the Carolinen and Ambrosius springs, are acidulated springs, poor in solid constituents, but containing 0·3 grain of carbonate of protoxide of iron, and therefore they may be regarded as chalybeate springs.

One great remedial resource, which gives Marienbad

the importance of a bathing resort as well as of a spa, and which is in much request, is the moor-baths (see page 295), the efficacy of which is probably essentially aided by the height of the situation, and in the estimate of a successful result from the Marienbad waters the springs and the moor-baths must be kept separate. The climate is not very mild, but colds are less frequently taken at Marienbad than at Carlsbad, and less frequently still than at Teplitz; as, indeed, a higher situation generally seems a protection from the influences of temperature.

[Marienbad is now likewise accessible by rail.—Drs. von Basch, Frankl, Herzig, Kisch, Lucka, Ott, Porges, and other physicians.]

Tarasp (or Tarasp-Schuls), in the Lower Engadine, Tarasp.
Canton Grisons, situated 4,000 feet above the sea, has only recently risen into fashion, though its springs have been known for centuries, and all circumstances combine to render it one of the most interesting and valuable spas. The springs contain the component parts of those of Carlsbad, Marienbad, Kissingen, and Vichy; the amount of iron, in itself small, does not come into consideration in waters thus composed. The coldness of the water can place no hindrance on its universal use, because the great amount of carbonic acid allows of its being warmed. In addition to this we may enumerate the advantages of its high situation, one of the highest for bathing resorts, the influence of the rarefied air in facilitating the change of substance and in rendering the necessary vital stimulus more bearable; further, combined with these, a mild summer climate, and, lastly, in contrast to the complicated social relations of Carlsbad and Marienbad, the conditions of a simple existence, stimulated by the enjoyment of Alpine scenery. The average temperature in July in the year 1858, was, in the morning at six o'clock, 10° Cent. (50° Fahr.), at two o'clock in the afternoon, 17.5° Cent. (63.5° Fahr.), and at nine o'clock in the evening 12.5° Cent. (54.5° Fahr.); the highest temperature at midday was 25° Cent. (87° Fahr.).

Putting out of the question several simple and weaker acidulated springs, we will take into consideration for our

present purpose the two principal springs, the great or St. Lucius spring, and the little or St. Emerita spring.

	Great spring.	Little spring.
Sulphate of soda	16.547	16.416
" lime	2.997	3.336
Chloride of sodium	29.400	29.381
Iodide of sodium	0.001	0
Bicarbonate of soda	38.542	42.370
" lime	17.894	17.850
" magnesia	7.680	7.582
" protoxide of iron	0.209	0.192
Free carbonic acid	33 (cub. in.)	28 (cub. in.)
Temperature	6.7° Cent. (44° Fahr.)	6.7° Cent. (44° Fahr.)

As regards the use of the Tarasp springs, in addition to all the cases adapted for Carlsbad and Marienbad, it is advantageous in many cases of bronchial catarrh and tubercles of the lungs, especially when these are complicated with stasis of the portal system. In these cases, the high position of the place and its equable and mild climate add their efficacy to the nature of the springs, and for this reason we consider it very desirable that the treatment of *diabetes* should be tried at Tarasp and the advantage of the springs tested.

[Tarasp may be reached by diligence or carriage from the station, Lanquart, near Ragatz, by way of the Praetigan, Davos Dorfli, and Fluela Pass; or from Innsbruck, by the Finstermunz Pass and Martin's brook; or from Coire by way of the Albula Pass, or the Julier Pass and St. Moritz.—Dr. Killias in the Kurhaus Tarasp, Dr. Arquial in Vulpera.]

Franzens-
bad.

Franzensbad, in the vicinity of the town of Eger, in Bohemia, situated 1,300 feet above the sea, possesses a fresh climate and excellent arrangements. The springs are generally designated as acidulated alkaline-saline chalybeates; the amount of carbonate of protoxide of iron in the different springs is 0.016, 0.068, 0.2, 0.328, and 0.376 grains in 16 ounces. Medical practice is not accustomed to expect a great effect of iron from springs containing 1-100th and 6-100th of a grain of carbonate of iron, and as the Louisenquelle, with its 0.328 of a grain, is used exclusively for baths, there remain as iron-springs only the

Wiesenquelle, with its 0.37 of a grain, and the Sprudel, with its 0.2 of a grain, and these are tolerably weak ones; and in the Salzquelle and the Franzensquelle we have no right to claim the effect as that of iron. The Wiesenquelle also can only exhibit any effect of iron, when it is given in non-aperient doses; however small the absorbed amount of iron may be, we know for certain that the effect of iron is generally connected with small doses.

	Salzquelle.	Wiesen- quelle.	Sprudel.	Franzens- quelle.
Sulphate of soda .	18	25	27	25
Chloride of sodium .	9	9	8	9
Bicarbonate of soda .	9	6	7	8
" lime .	2.3	1.6	2.3	2.3
Carbonate of prot. of iron	0.016	0.37	0.2	0.06
Carbonic acid . .	27 (cub. in.)	31 (cub. in.)	39 (C. in.)	40 (cub. in.)
Temperature . .	10.2° Cent. (50.36° F.)	10.6° Cent. (51.1° F.)	10.6° C. (51.1° F.)	10.2° Cent. (50.36° F.)

The springs of Franzensbad, therefore, in their principal component parts, are like those of Carlsbad, only that they are more cold, and contain more carbonic acid and also somewhat more sulphate of soda. The fate of a spa is very often dependent on the manner of its first application, and this frequently for a long time gives it its character. At Franzensbad from the first, mild stimulating treatment was usual in the case of individuals requiring gentle management, individuals who had become exhausted from the treatment used at Carlsbad, with hot water, taken, as was then the custom, in large quantities; hence the first visitors were especially persons suffering from anæmia, thin and emaciated hypochondriacs, and hysterical constitutions, and this character has been retained by the frequenters of the spa, and, in like proportion, the gentle mode of treatment has been continued and developed. Conditions of this kind ought to be taken into consideration in the general estimation of a spa: the kind of visitors and the local treatment are often just as important for the estimation of a spa as the constitution of the springs. Waters containing 18 to 25 grains of Glauber's salt, 9 grains of common salt, and 6 to 9 grains of bicar-

bonate of soda, predominantly used for excitable and weakly individuals, and therefore for the most part given in small doses, are very well able gently to stimulate the retrogressive part of the change of substance, without interfering with the progressive part; and there is in no wise any occasion to recur to the small amount of iron taken, in explaining the final effect, and this all the less, as the two oldest and still most used springs, the Salzquelle and the Franzensquelle, possess only the minimal amount of iron, the 1-100th and 6-100th of a grain. The effect, at any rate, of these two springs is produced by the amount of salt and gas; they slightly stimulate digestion and change of substance, they thus promote nutrition and the formation of cells, apart from their local influence on the abdominal organs; and in promoting the formation of cells they assist also in the acquirement of iron from its natural source, namely, from the food. Generally speaking, Franzensbad is adapted for all cases in which a strongly exciting effect from the hot Carlsbad springs is to be feared, and it is especially suitable for the already mentioned type of thin atrophic hemorrhoidal subjects, which, whenever medicinal waters are indicated, affords a grateful object for these cold waters and their mild treatment. Among the cases of *anæmia* there are a great number which cannot bear simple chalybeates, because these constipate the bowels, or because they have no effect on them; such especially are cases in which a degree of so-called weakness of the nerves, for the most part proceeding from spinal irritation, contra-indicates the use of iron; especially, therefore, women who have become anæmic from spinal irritation and disease of the uterus. In these cases, generally, stimulating and mild treatment is suitable, such as sea-air, mountain-air, indifferent baths, gentle courses of saline waters, and, among others, of the springs of Franzensbad. Hence it is that at this place there is an influx of women suffering from uterine diseases, a fact which partly proceeds from the predilection of some of the physicians, and upon which Hauck expresses himself sharply, but not unjustifiably.¹

¹ *Heilquellen Deutschlands*, 1865.

Two essential remedial resources, however, are added to the use of the springs, namely, the baths with the not inconsiderable amount of gas preserved when heated, and above all the *moor-baths*. The former may be considered as baths with a slight effect of carbonic acid, and the latter as a peculiar variety of the thermal system; they produce a powerful effect, especially upon those sick persons requiring gentle treatment, who form the main visitors at Franzensbad.¹

(Drs. Boschan, Cartellieri, Köstler, Hamburger, Meissl, and other physicians.)

Elster, in Saxony, is situated between Plauen and Franzensbad, on the Bohemian frontier, 1,460 feet above the sea, with a tolerably mild and fresh climate. From the following analysis, it is evident that the springs are chiefly to be distinguished from those of Franzensbad by a greater amount of iron, which in one spring even equals that of Driburg. The cases adapted for its use, therefore, accord pretty much with those of Franzensbad, but with this difference, that at Elster more is to be expected from the effect of iron, presupposing that investigations, which are still lacking, on iron-waters containing salt, and therefore promoting the secretion of the bowels, prove a considerable absorption of the iron. *Moor-baths* are also, as at Franzensbad, constantly used, and in both places a great number of cases fall to them which do not stand in direct relation with the mineral waters.

	Marlen- brunnen.	Königs- brunnen.	Alberts- brunnen.	Moritz- brunnen.
Sulphate of soda .	22.6	16.0	24.3	7.3
Chloride of sodium .	14.3	11.3	8.1	5.3
Bicarbonate of soda .	5.7	5.8	6.8	2.1
Carbonate of lime .	1.1	1.3	0.8	0.8
" protox- ide of iron .	0.35	0.46	0.32	0.48
Carbonic acid .	28 (cub. in.)	36 (cub. in.)	16 (cub. in.)	33 (cub. in.)
Temperature .	10° Cent. (50° Fahr.)	10° Cent.	10° Cent.	10° Cent.

Besides these, there is a spring without iron, which in its amount of Glauber's salt surpasses all the waters here

¹ See further details respecting the moor-baths, p. 295.

mentioned, namely, the Salzquelle with 48 grains of sulphate of soda, 12 grains of chloride of sodium, 7 grains of bicarbonate of soda, 25 cubic inches of carbonic acid, and 8° Cent. (46·4° Fahr.). Lastly, there is a simple acidulated spring with 4·6 grains of Glauber's salt and only 1·8 grains of bicarbonate of soda.

[Elster is a railway station on the line from Altenburg to Eger.—Drs. Cramer, Flechsig, Löbner, and others.]

Füred

Füred, in Hungary, can only be reckoned among alkaline waters containing sulphate of soda, in a chemical and qualitative point of view, but in no wise in a therapeutic respect; with its 6 grains of sulphate of soda, $\frac{7}{10}$ grain of chloride of sodium, 1 grain bicarbonate of soda, not quite $\frac{2}{10}$ grain of carbonate of protoxide of iron, and 6 grains of carbonate of lime, it is nothing more than a cold acidulated water, the effect of which in removing acidity may be ascribed to its amount of lime. The amount of carbonic acid is considerable (38 cubic inches). [Drs. Orzowski and Schindler.]

Bertrich.

Bertrich, situated in a narrow and charming valley, opening into the Mosel, and belonging to the volcanic Eifel range, about 500 feet above the sea, is also classed among the Glauber's salt waters, without deserving the name any more than Füred. Seven grains of Glauber's salt, 3 grains of common salt, not quite 2 grains of bicarbonate of soda, $4\frac{1}{2}$ cubic inches of carbonic acid, and a temperature of 32·5° Cent. (90·5° Fahr.), render the spring, as regards baths, an indifferent therma of moderate temperature, slight amount of gas, and little elevation, and render it, as regards mineral waters, a very weak Glauber's salt water, in all essential component parts three times as weak as the Carlsbad springs. The cases adapted to it therefore appear principally in the first book, from its analogy with indifferent thermæ, but they are more accurately determined by the peculiarities of the place; namely, very mild climate, beautiful and romantic nature on a small scale, cheap and quiet, life in a wooded valley, and simple but in no wise poor arrangements.

[This charming and in many respects useful place has as yet no railway communication. It is reached either

from Trèves or Coblenz by the Moselle steamers or by carriage.—Dr. Cüppers.]

Stubnya, in Hungary, possesses springs of 44° Cent. Stubnya.
(111·2° Fahr.), containing a few cubic inches of carbonic acid and a similar small amount of salt with Bertrich and Füred. It belongs accordingly likewise to the in-different thermæ.

Rohitsch, in Styria, three hours from Cilli, in a beautiful situation and with the mildest climate, 730 feet above the sea, possesses springs which are abundantly transmitted to other parts, to as much as 1½ millions of jars yearly, and which are drunk on the spot by some thousands of visitors. The principal spring, the Tempelbrunnen, contains 15 grains of Glauber's salt, 0·7 grain of common salt, 8 grains of bicarbonate of soda, 11 grains of carbonate of lime, 10 grains of carbonate of magnesia, 0·09 of carbonate of protoxide of iron, 25 cubic inches of carbonic acid, and it is 10° Cent. (50° Fahr.) warm. It is accordingly a weak Glauber's salt water, but without the admixture of common salt, though, on the other hand, with a great amount of bicarbonates; and it is adapted for slight cases of dyspepsia, acidity of the stomach, and other conditions suited to the use of Glauber's salt waters. The climate admits of the waters being taken in spring and autumn. It is an hour distant from the Pöltschach station on the South-Austrian railway, about midway between Trieste and Vienna. (Drs. Frohlich, Schüler, and Sock.) Rohitsch.

CHAPTER V.

COMMON-SALT-WATERS.

As in soot-baths outwardly, so in courses of drinking, among all the component parts of mineral waters, common salt is most frequently represented. It plays also an important part in many mineral springs which are named after other characteristic component parts; in several bitter-waters, in most of the chief sulphate-of-soda-waters, in a great number of soda-waters, and in some sulphur-springs, the chloride of sodium exists in considerable quantities and has a very essential share in the effect, according to its amount; for the empirical use of real common-salt-waters claims almost all the classes of cases (and in some instances successfully) which experience has proved as adapted for the use of soda, sulphur, and Glauber's salt waters; and whilst the Glauber's salt waters in their physiological and therapeutic effect form to a certain extent the antipodes of the steel-waters, the common-salt-waters exhibit manifold affinity with the latter, and there are numerous cases of anæmia which have been cured by the gentle use of common-salt-springs, after chalybeates have proved unsuccessful, or in which the one remedy has acted as efficaciously as the other.

This again illustrates the maxim, in which (page 9) we expressed the general characteristic of Balneotherapeutic experience: *cases of sickness of very different kinds are cured and improved by one and the same medicinal spring, and cases of similar nature are cured and improved by very different medicinal springs.* Both clinical experience as to the therapeutic effect of common-salt-waters, as well as views with regard to the physiological importance of chloride of sodium, although ex-

pressed but scantily, are precise enough to illustrate this general statement in this special case; and in the explanation of common-salt-waters far less uncertainty prevails than in other questions of Balneotherapy.

PHYSIOLOGICAL EFFECT OF COMMON SALT.

In order not to be too diffuse, we must satisfy ourselves with enumerating facts without mentioning each of the well-known authorities separately; and it will be evident that clinical experience with regard to the therapeutic importance of common salt is to be explained readily and without difficulty from its physiological relations.

1. Chloride of sodium is a constant component part of all animal juices and tissues, constant in a twofold respect, both in its appearance generally and in its quantitative proportion.

Chloride of sodium in the blood.

2. Chloride of sodium is not only the most constant of all the mineral component parts of the juices and tissues, but it is also the predominant element as regards quantity.

3. Chloride of sodium accompanies most, and probably all protein matter, and is necessary for its solution in the constituent fluids, especially the solution of the fibrine in the blood and of the albumen in the serum of the blood and of the secretions; on the other hand it checks the solution of the blood-corpuscles, and in general promotes the formation and preservation of those cells which, forming the main component part of normal and diseased transudations, have no plastic function to fulfil.

4. In connection with the last statement, we find everywhere, where considerable normal or abnormal masses of cells are deposited, great abundance of common salt in the fluids, for instance, in pus, in synovia, and in the exudation of grey hepatisation of the lungs.

Chloride of sodium in cellular tissues and secretions.

5. On the other hand, chloride of sodium has also a considerable share in exudations which contain no cells, as in the hydropic fluid; generally speaking, wherever fluid transudes from the blood, chloride of sodium is concerned, and this beyond all other salts.

Chloride of sodium in transudations.

6. As with regard to cellular and non-cellular exuda-

Chloride
of sodium
and urea.

tions, so chloride of sodium is also a constant accompaniment to urea, i.e., to the most important representative of the final result yielded by the retrogressive metamorphosis of protein matter; and this accompaniment seems even to consist of a real and true chemical combination, and that in such a manner that the presence of common salt, and not the urea, is the necessary condition.

7. In connection with the circumstance last mentioned, it appears that a certain measure of the elimination of urea through the urine is dependent on the quantity of chloride of sodium in the blood; the less common salt is taken, or the more of this salt is used for pathological transudations or physiological cellular formation, the less is the amount of urea evacuated; the more, however, common salt is supplied to the blood, the greater is the excretion of urea, and at the same time the greater the amount of common salt appearing in the urine.

8. Chloride of sodium, when it is introduced in considerable but not excessive quantities, is quickly absorbed by the stomach, and in a short space of time, that is, after some hours or half a day, it is again eliminated through the urine; the increase of urea does not appear at once with the increase of common salt in the urine, but it accompanies the latter period of the elimination of the common salt, and frequently only reaches its maximum, after the excess of chloride of sodium has been in a great measure removed.

9. It follows from this that the animal economy is sparing of its store of common salt, if from deficient supply or from abnormal consumption it fall below a certain amount, but that it very quickly employs an excess in transforming protein matter into urea, and after this use of it, it at once equalises the excess by elimination. From the latest experiments¹ it even appears further, that the organism is able to lay up a store of common salt, and this only to a small extent in the blood, but to a greater extent in the tissues, from which it is easily lixiviated by the absence of food containing common salt.

¹ Klein und Versen, *Schmidt's Jahrb.* 1868. No. 6.

10. We have, however, no reason to imagine the general effect of common salt in the change of substance to be a destructive one, because from its prolonged use, in spite of the increased elimination of urea, we do not find as a rule any emaciation and weakness produced, but on the contrary good nutrition and general health ; in the use of common-salt-waters, when they do not produce catarrh of the bowels and dyspepsia, owing to very large doses, only a slight decrease of fat is, as a rule, observed, and no diminution at all of the weight of the body. Chloride of sodium has, accordingly, in addition to its retrogressive effect, also a conservative and progressive effect ; and this is the most important point which distinguishes it from carbonate of soda and Glauber's salt. This conservative importance results partly from its tendency to increase cellular formation,¹ and partly from the share in the digestion of food taken by the free muriatic acid in the gastric juice, which is traced to the chloride of sodium in the blood as its source ; and thirdly, we must add the amount of chloride of sodium in the gastric juice itself, which is the most important condition for the plentiful solution of albuminous substances.

Importance as regards the change of substance.

11. The mechanical condition for all these relations can be no other than the endosmotic property of the blood, as a saline solution which surpasses most animal fluids in concentration ; it is all, at any rate, to be explained by Liebig's theory, according to which the vascular system, from the amount of common salt in the blood and from the laws of endosmosis, represents a kind of absorbent apparatus.

Endosmotic property of chloride of sodium.

12. This theory does not contradict the rapid absorption of common salt by the stomach itself. The immediate effect on the stomach is increased secretion, and therefore a dilution of the solution of common salt introduced ; this is succeeded by rapid and violent absorption, which is connected with the feeling of extreme thirst. The direct immediate effect is increase of the secretion of the stomach. Very strong doses very speedily produce fluid vomiting, and fluid evacuation if the vomiting do

Local effect on the stomach and bowels.

¹ See Sect. 4, p. 385.

not soon take place. Small and moderate doses, however, do not reach the bowels, and produce no local effect on them; the influence on the bowels is far rather indirect, and consists partly in the stimulation of the intestinal absorption by the increased amount of common salt in the blood passing through the intestinal walls, and partly in the supply of chyme, the most important component parts of which are completely dissolved, and which therefore spares the intestinal membrane from coming into contact with irritating and fermenting substances; from this probably proceeds the good effect of moderately strong common salt waters in cases of chronic catarrh of the bowels.

13. Chloride of sodium also takes an important part in the solution and digestion of the amylacea. This is evident from the experience that amylaceous food is all the more quickly digested, the more common salt is added to it; it is also apparent from the great amount of common salt in the saliva and pancreatic juice, and from the constant combination of sugar with chloride of sodium in diabetic urine.

Summary.

14. As a summary of the above, the following general characteristics may be given as the effect of chloride of sodium. In the first place, in the stomach itself, added to the food, it exhausts as a solvent its amount of albumen and starch-flour, and thus promotes the digestion and appropriation of food; in the second place, it supplies the intestines with chyme well prepared as regards albuminous substances and starch; in the third place, it supplies the amount of common salt in the blood required for absorption, secretion, and change of substance, without permanently overloading the blood, inasmuch as it is again speedily evacuated, or also laid up in store in the tissues.

15. Among the other chlorides which usually accompany common salt in mineral waters, it is only known of chloride of magnesium that it more strongly stimulates the intestinal mucous membrane, of chloride of calcium that it is subject to decomposition in the intestines and stomach, and of chloride of potassium that it exercises a

far greater effect on the retrogressive change of substance, especially on the elimination of iron.¹

From the above sketch of the physiological importance of *chloride of sodium*, its *therapeutic character* may be given theoretically in a few statements which will be more intelligible when we come to the examination of the cases empirically proved to be adapted for its use. Chloride of sodium may be given as a remedy—

Therapeutic character.

1. In *atony of the secretions of the stomach* which accompanies various stages of dyspepsia and catarrh of the stomach, or which is a local consequence of general atrophy and anæmia.

2. In indifferent activity of the *functions of the bowels*, in order to supply the intestines with perfect and better prepared chyme.

3. For the purpose of maturing those secretions and new products which are characterised by the numerous formations of cells: as *phlegm* and *pus*.

4. To excite the *absorbent function* of the vascular system, and this partly for the purpose of absorbing pathological productions, and partly for the stimulation of the retrogressive change of substance.

5. To *quicken both the retrogressive and productive change of substance*, and therefore to improve nutrition generally.

The dose, with which the fulfilment of the above-mentioned purposes is combined, amounts in most cases to from 1 to 5 drachms in the daily quantity of water. If it be below this minimum, its effect is limited partly to a just perceptible stimulation of the functions of the stomach, and partly to a slight augmentation of the chlorides in the blood and the consequences mentioned under heads 3 to 5; if, however, it exceed the average maximum, it may easily irritate the stomach and intestines, and by disturbing the digestion and assimilation counteract the therapeutic intentions mentioned. Among the accompanying properties of common-salt waters, the most important are the amount of carbonic acid, the temperature, and the concentration. The carbonic acid produces especially a local

Dose.

Concomitant properties of common-salt-waters.
Carbonic acid.

¹ Wroninechin, *Schmidt's Jahrb.* 1868. No. 6.

Tempera-
ture.

effect on the stomach by intensifying the action of the chloride of sodium ; it increases the secretion, and at the same time the peristaltic action of the stomach and intestines. While, accordingly, on the one side it promotes the absorption of a weaker solution of salt, it accelerates, on the other hand, the removal of a stronger solution into the intestinal canal, and thus causes increased secretion which may readily pass into diarrhœa, and this diarrhœa has very frequently an irritated catarrhal character. The *temperature* has a similar influence. The cold of the water increases the local stimulating effect upon the stomach, partly by the stimulant of cold, and partly by retarding the absorption of the solution of common salt ; the heat of the water, on the other hand, diminishes the irritation of the salt and accelerates its absorption ; hence even stronger waters are often not aperient, when they possess a high temperature. On the consideration of these three conditions, the *carbonic acid*, the *temperature*, and the *concentration of the water*, the choice of the different common-salt-waters rests exclusively in each individual case, and it ought not to be guided by habit and balneological literature which connect the *names* of the various spas with certain classes of cases. The amount of gas may, for example, be essentially diminished by prolonged standing or motion ; the temperature of gaseous waters may be essentially heightened without causing any other change than that the oxide of iron and lime fall to the bottom ; sediments may be allowed to settle, and nothing is lost by them. The effect of iron in strong salt-waters is, as we shall mention when speaking of the chalybeates, more than questionable, and the separation of the lime is an advantage.

Kissingen
and Wies-
baden.

The two contrasts among common-salt-waters, as regards temperature and amount of gas, are *Kissingen* and *Wiesbaden*. Both are all the more to be compared with each other, as they possess an average amount of common salt ; we shall, therefore, in our examination of the ordinary uses of common-salt-waters, pay special attention to these two chief representatives, and subsequently, in enumerating the different springs, we may group them round one

of these two spas. For this purpose we will here anticipate their more important properties.

	Kissingen Ragoezi.	Wiesbaden Hochbrunnen.
Temperature . . .	10·6° C. (51·11° F.)	68·7° C. (155·7° F.)
Carbonic acid . . .	41 (cub in.)	6 (cub. in.)
Chloride of sodium . .	44·71 (gr.)	52·49 (gr.)
Carbonate of lime . . .	8·14 "	3·21 "
" protox. of iron	0·24 "	0·04 "

EXAMINATION OF CLASSES OF CASES.

1. *Dyspepsia and Catarrh of the Stomach.*—These two Dyspepsia. names may be here placed together, not because they denote similar conditions, but because in medical practice, and especially in the enumeration of balneotherapeutic results, they constantly appear confounded with each other. Although the symptoms of dyspepsia are always combined with catarrh, and the latter frequently begins with dyspepsia, still it is a disease *sui generis*, in no wise so frequent as it is stated to be, but accompanied with severe consequences (page 331), and generally requiring a more energetic method of treatment.

Dyspepsia requires and admits many different stimulants to the stomach: ice, cold water, carbonic acid, common salt, and when a considerable increase of acidity causes or accompanies the condition, neutralising carbonates of alkalis and earths. Among these the alkalis are generally to be preferred, because they are more easily absorbed; of the earths, however, carbonate of magnesia is to be preferred to carbonate of lime, which is only slowly absorbed; yet under some circumstances the effect of magnesia in increasing the secretion of the bowels requires attention. The effect of common salt in the form of salted herrings and sardines in cases of acute dyspepsia, is well known, and common-salt-waters are also among the most usual and best remedies for chronic dyspepsia, but under the following conditions.—1. They must be taken cold, because high temperature counteracts the intended irritation and accelerates too rapidly the absorption of the salt;

2. No excessive acidity of the stomach ought to exist, because it belongs to the effects of the absorbed chloride of sodium to increase the secretion of the muriatic acid in the gastric juice. 3. The water ought not to be concentrated, and the separate and entire dose ought to be small. 4. These small doses ought to be assisted by a considerable amount of carbonic acid, in order to increase the digestibility of the water and the stimulation of the stomach. Hence warm, gasless, and moderately strong as well as cold concentrated sool-waters are unsuitable and are even able to produce dyspepsia; on the other hand, the ordinary doses of Kissingen waters, and smaller doses of Homburg waters, are the extreme amount permitted; and very frequently weaker waters are sufficient, so long as they are cold and gaseous; for instance, Cronthal with 22 grains of chloride of sodium, and the weaker springs of Soden with 17 to 26 grains. And even some alkaline muriatic chalybeates with a small amount of bicarbonate of soda and a larger one of common salt, owe their effect in cases of dyspepsia in great part to the latter element, such, for instance, as Roisdorf and Selters with only 6 grains of carbonate of soda, but with 14 and 17 grains of chloride of sodium.

Catarrh of
the
stomach.

For the local treatment of chronic catarrh of the stomach, the rule may be laid down that the malady requires stimulating remedies, but very frequently it cannot bear them, or cannot bear every one of them. Very often the choice of remedies must be made a matter of experiment, and the maxims which may be taken as a guide in such an experiment are pretty much as follows.¹

In most cases *carbonic acid* seems to be an endurable and gentle stimulus, yet its effect rather concerns the action than the secretions of the stomach. The latter are, on the other hand, most strongly affected by *common salt*, which, besides spices, is the chief means for stimulating and regulating the secretions of the stomach, and especially for maturing their catarrhal products. The atony of the membrane, which develops itself in time, and the inclination to vomiting, render in some cases warm water unbearable, and *cold* is required as a third stimulant. Lastly, it is for the

¹ See also p. 331 *et seq.*

most part small doses of chloride of sodium which set a limit to the stimulation, namely, doses of a half or a whole drachm; while larger ones as a rule produce dyspepsia and increase all the symptoms of disease. Accordingly, in a great number of cases, those weaker and moderately strong common salt waters are indicated, in which, owing to the assistance of the carbonic acid and cold, smaller doses of chloride of sodium are sufficiently active, such as Kissingen, and occasionally Homburg, the former with 44 grains of chloride of sodium, the latter with 80 (Elisabethenbrunnen), Soden, with 17 to 26 grains, Canstatt, with 16 to 19 grains, Cronthal, with 22 to 27 grains, and Selters, with 17 grains of chloride of sodium, belong to this number.

In cases where even such cold, gaseous, and moderately strong common-salt-waters cannot be borne, but the catarrh and dyspepsia are aggravated by them, various similar warm waters, especially *Wiesbaden*, have been tried, and the statistics of the results prove that in this warm solution also, in which, however, 6 cubic inches of carbonic acid are to be taken into account, the salt manifests its effect. Probably, however, the quickly absorbed chloride of sodium acts as an antiscatarrhal remedy through the blood.

In many cases, sometimes instead of the previously untried common salt waters, and sometimes after unsuccessful trials, cold and also warm *soda-waters* have proved successful, the locally weakening effect of the soda on the stomach being cancelled by the general antiscatarrhal effect of the soda in the blood (p. 323). The soda is in these cases given with the same intention as in chronic bronchial and other catarrhs, namely, in order to mature the secretions through the blood. The same effect, however, is also produced by the absorbed chloride of sodium, as we mentioned at pages 387 and 389, and this is added to its local effect. As large doses of carbonate of soda very readily produce a locally dyspeptic effect, the weaker *soda-waters* have, generally speaking, proved most efficacious, and especially those which contain either the corrective of carbonic acid and of chloride of sodium, or which, taken warm, render possible the rapid absorption of the soda,

and its short sojourn in the stomach. Hence the strong soda-waters containing no common salt, such as *Bilin*, *Fuchingen*, and *Vichy*, are far less efficacious in catarrh of the stomach than the weaker ones containing common salt, such as *Selters*, *Roisdorf*, *Gleichenberg*, *Ems*, and *Apollinaris*; and even strong soda-waters have been tried and borne, when a considerable amount of chloride of sodium and carbonic acid is added to them, such as the weaker spring of *Luhatschowitz*, with its 33 grains of bicarbonate of soda, 23 grains of chloride of sodium, and 50 cubic inches of carbonic acid.

The effect of these waters is therefore partly general, inasmuch as both the carbonate of soda and the absorbed chloride of sodium promote cellular secretions and formations, but it is also partly local, owing to the contact of the chloride of sodium and the carbonic acid with the membrane of the stomach.

If, moreover, in the most obstinate cases even those complicated waters have proved successful, such as *Marienbad*, *Carlsbad*, *Tarasp*, *Franzensbad*, and *Elster*, which contain Glauber's salt in addition to carbonate of soda, chloride of sodium, and carbonic acid, the effect produced by these is partly to be explained by the reasons just discussed, though we may at the same time observe that the local influence upon the stomach of the Glauber's salt afforded by them is very slight; but their effect, on account of the Glauber's salt, is partly directed against a symptom which accompanies most cases of catarrh of the stomach with injurious local and general consequences, namely *constipation of the bowels*. If large aperient doses of common salt were used to counteract this complication, the catarrh of the stomach would be aggravated, and catarrh of the bowels would be added; but moderate doses of Glauber's salt, seldom sufficient in themselves to produce an aperient effect, appear in those waters, in combination with common salt and carbonic acid, to be enough to stimulate the secretion and action of the bowels without irritating the stomach injuriously. If considerable stasis of the abdomen, especially enlargement of the liver, accompany the catarrh, the Glauber's salt waters are of course to be preferred before all others.

Lastly, there is one more alternative of importance, which follows from the general condition of the sick person. Catarrh of the stomach, if of any duration, always disturbs the nutrition and the physical powers, and this aspect of the malady requires all the more early attention, as there is a fear that it may end in atrophy, *tabes dorsalis*, and tubercles in the lungs. Hence, besides direct remedies, early and generally strengthening treatment is indicated, such as travel, sea-air, sea-baths, the stimulating form of the cold-water system, and the like. The more, therefore, that in the individual case regard is paid to the general indisposition, the bad nutrition, and the scanty formation of blood, the more in the choice of medicinal waters must attention be directed to the avoidance or the restriction of aperient and lowering treatment; and, so far as possible, the physician must be satisfied with the mild effect of moderate common-salt-waters, or with allowing a strengthening course of treatment to succeed a lowering one. Generally speaking, in no case of any duration is it to be overlooked that, in consequence of the catarrh, an incurable dilatation of the stomach easily arises, sometimes caused by the metamorphosis of the muscular tissue into fat, sometimes by excessive development of cellular tissue. These cases must be restricted to dietetic and tonic treatment.

Strengthening methods in catarrh of the stomach.

2. *Chronic Ulcers in the Stomach*¹ are still frequently treated at common-salt-springs, but judicious practitioners can scarcely regard such experiments as justifiable, as the use of large quantities of salt-water is in these conditions a grave dietetic error.

Ulcers in the stomach.

3. *Chronic Catarrh of the Bowels*.—If this arise from weakness of skin and constant colds, courses of mineral waters and internal remedies generally, are without effect, unless, as was shown in the first book, the cause be removed by baths that invigorate the skin. If the catarrh, however, be independent, warm soda-waters, and especially warm common-salt-waters, are frequently of great benefit—both of them from the anticatarrhal effect of their salts on the blood, and the common salt waters especially, from their effect in improving the gastric digestion which

Catarrh of the bowels.

¹ See p. 371.

spares the irritated intestine contact with undigested and fermenting chyme. Care must, however, be taken that no considerable quantities of common salt come into contact with the intestine itself; hence weak and warm waters are to be preferred. If, however, the morbid condition be accompanied with constipation of the bowels, and if for this reason the latter require to be stimulated, the weaker and warm Glauber's salt water of Carlsbad may be selected; but in no case a strong common-salt-water or large doses of a weak one, because the aperient effect of the chloride of sodium itself consists in a catarrhal irritation of the intestinal mucous membrane, while the Glauber's salt waters only cause a serous evacuation, without much irritation.

Plethora
abdomi-
nalis.

4. *Plethora Abdominalis* [congestion or hyperæmia of the abdominal organs from sluggish venous circulation].—We have but little to say with regard to the alternative between Glauber's salt and common-salt-waters, in addition to the remarks which we have already made on the subject (p. 368) when speaking of the effect of Glauber's salt waters in cases of stasis of the abdomen and hemorrhoidal conditions. Even when common salt plays its part in Glauber's salt waters, it appears in them in such moderate quantities that it can only slightly increase the effect on the retrogressive change of substance, and on the other hand it can very well manifest its productive effect and can act beneficially in stimulating the stomach. The true common salt waters are suitable only for that slight degree of the corpulent hemorrhoidal type (p. 368), in which a great diminution of substance is little or not at all demanded. If in higher degrees of this type of disease an attempt be made, as is unfortunately often the case, to force the aperient effect by strong common-salt-waters, emaciation is, it is true, obtained, but not of the fat alone; a disturbance rather of the digestive functions is caused, a catarrh of the bowels, forming in itself a new disease and a new object of treatment. Upon this rests the alternative existing between Kissingen, Carlsbad, or Marienbad, and the like. Moderate courses of treatment at Kissingen and Homburg obtain the same result in moderate cases as at Carlsbad and Marienbad; in severer cases they fail in their

effect of absorbing the fat, and if strongly used they produce, it is true, emaciation, but at the expense of the digestion and the health; whilst Carlsbad and Marienbad diminish the fat without injuring the digestion and the formation of blood.

The case is different with the atrophic type (p. 369). When in these cases, in addition to the general tonic measures already mentioned, direct attempts are to be made for the regulation of the change of substance, methods of treatment that diminish substance are to be utterly rejected, and weak, but only weak common salt waters are to be preferred; very small doses of Kissingen and Homburg waters, or better the weak waters of Cannstatt, Cronthal, Soden, Baden-Baden, and others. Stimulation of the stomach by small doses of chloride of sodium and moderate stimulation of the retrogressive and productive change of substance, is the object in view, and this is aided by the coldness and the carbonic acid of the waters. Warm waters, like Baden and Wiesbaden, are to be preferred if it be desired to spare the stomach prolonged contact with the chloride of sodium, and especially to prevent the effect of this upon the bowels.

5. *Liver-Diseases.*—A special relation of common salt to the change in the functions of the liver, has been nowhere proved, especially not as regards any direct increase of the secretion of bile. Only when larger doses of common salt stimulate the stomach and intestines to greater secretion, do we find, as with most remedies producing the same effect, the secretion of bile increased, probably because the stimulation is transmitted to the liver by means of continuity or sympathy.

Liver-diseases.

All that is stated with regard to the cure of *catarrhal icterus* by common-salt-waters, possesses the same importance as that which belongs to other remedies. Catarrhal icterus disappears gradually with any treatment, and the remedies used are designed to stimulate the stomach; hence weak, and none but weak, salt-waters may be given as stomachics, especially those which are gaseous and cold. *Gall-stones* also have sometimes been seen to yield to any treatment, and to disappear under the use of cold and

warm common-salt-springs, as well as under the use of plentiful drinking generally. Whether the frequently tested effect of Carlsbad proceeds from the excellence of the constitution of the water, or whether it is the consequence of the fact that a great number of persons suffering from gall-stones resort thither for treatment, we know not; but we are inclined to give the preference to alkaline and Glauber's salt waters beyond common-salt-waters, because the former can in general be taken in larger quantities, and we imagine that much depends on the plentiful use of fluid, and perhaps also on the secretions of a bile more devoid of fat.

In cases of hyperæmic, cirrhotic, and fatty liver, common-salt-waters frequently come into competition with Glauber's salt springs, and produce an effect like the latter, partly by sympathetic irritation of the liver, and partly by stimulating the change of substance generally and by promoting circulation in the portal vein. In slighter cases the choice between the two springs is perhaps indifferent, but in severer ones the Glauber's salt waters are, generally speaking, to be preferred; in the first place because their effect is more empirically tested, and hence greater guarantee is afforded against useless experimenting; and in the second place because frequently considerable diminution of substance is necessary, and this is effected by common-salt-waters only at the expense of digestion and nutrition.

Splenic
tumours.

6. The case is otherwise with hyperæmic enlargements of the *spleen*, caused by intermittent fever and malaria. In this case the effect of the two principal remedies, bark and iron, is essentially assisted by mineral waters, and is even frequently supplanted by them; above all by common-salt-waters, and this by moderate doses which facilitate the rapid absorption of the chloride of sodium. The successful results boasted of Glauber's salt waters may be traced probably to their amount of common salt, and the effect of the latter is certainly connected with its influence on the formation of cells.

Bronchial
catarrh.

7. *Bronchial Catarrh and Tubercles in the Lungs* [consumption].—The anticatarrhal effect of common salt

by maturing the secretions, is exhibited especially in cases of catarrh of the respiratory membrane, and the preference of alkaline muriatic waters to simple soda-waters rests on the combination of the chloride of sodium with the carbonate of soda. Also weaker common-salt-waters, in the constitution of which carbonate of soda has no part, have this effect, and often very promptly, improving the digestion and the nutrition at the same time, especially in cases where dyspepsia and the sluggish functions of the bowels are combined with the catarrh. Of course, the conditions of an equable moist and warm climate assist the treatment; and to the combination of these circumstances with weak but gaseous common-salt-springs, *Soden* owes its reputation in cases of bronchial catarrh, even in those which are complicated with commencing consumption. The power of the chloride of sodium in increasing nutrition and promoting digestion corresponds with the requirements of many of these cases, and the amount of iron in the *Soden* springs scarcely contra-indicates their use in consumptive persons, as any heating effect from the iron is very doubtful, and its constipating effect is counteracted by the carbonic acid and the chloride of sodium. Like *Soden*, all other weaker common-salt-waters can be given, and the choice must be specially regulated according to climatic circumstances.

Tuberculosis.

8. *Gout*, as a dyscrasia, requires, as we have repeatedly stated, vigorous treatment, stimulating the retrogressive change of substance, the energetic use of all the forms of warm baths, and lixiviating treatment with pure water, soda-waters, and Glauber's salt waters, among which the latter, and especially the warm springs of Carlsbad, justly enjoy the highest reputation. For common-salt-waters, especially the weaker sort up to Kissingen and Wiesbaden, we reserve those numerous cases in which a wise prognosis relinquishes all hope of cure, and only strives after moderate acceleration of change of substance, at the same time keeping up nutrition. If, however, the retrogressive metamorphosis require to be vigorously accelerated, the physician must be satisfied with the use of Glauber's salt waters, and must not have recourse to strong common salt

Gout.

warm common-salt-springs, as well as under the use of plentiful drinking generally. Whether the frequently tested effect of Carlsbad proceeds from the excellence of the constitution of the water, or whether it is the consequence of the fact that a great number of persons suffering from gall-stones resort thither for treatment, we know not; but we are inclined to give the preference to alkaline and Glauber's salt waters beyond common-salt-waters, because the former can in general be taken in larger quantities, and we imagine that much depends on the plentiful use of fluid, and perhaps also on the secretions of a bile more devoid of fat.

In cases of hyperæmic, cirrhotic, and fatty liver, common-salt-waters frequently come into competition with Glauber's salt springs, and produce an effect like the latter, partly by sympathetic irritation of the liver, and partly by stimulating the change of substance generally and by promoting circulation in the portal vein. In slighter cases the choice between the two springs is perhaps indifferent, but in severer ones the Glauber's salt waters are, generally speaking, to be preferred; in the first place because their effect is more empirically tested, and hence greater guarantee is afforded against useless experimenting; and in the second place because frequently considerable diminution of substance is necessary, and this is effected by common-salt-waters only at the expense of digestion and nutrition.

Splenic
tumours.

6. The case is otherwise with hyperæmic enlargements of the *spleen*, caused by intermittent fever and malaria. In this case the effect of the two principal remedies, bark and iron, is essentially assisted by mineral waters, and is even frequently supplanted by them; above all by common-salt-waters, and this by moderate doses which facilitate the rapid absorption of the chloride of sodium. The successful results boasted of Glauber's salt waters may be traced probably to their amount of common salt, and the effect of the latter is certainly connected with its influence on the formation of cells.

Bronchial
catarrh.

7. *Bronchial Catarrh and Tubercles in the Lungs* [consumption].—The antieatarrhal effect of common salt

by maturing the secretions, is exhibited especially in cases of catarrh of the respiratory membrane, and the preference of alkaline muriatic waters to simple soda-waters rests on the combination of the chloride of sodium with the carbonate of soda. Also weaker common-salt-waters, in the constitution of which carbonate of soda has no part, have this effect, and often very promptly, improving the digestion and the nutrition at the same time, especially in cases where dyspepsia and the sluggish functions of the bowels are combined with the catarrh. Of course, the conditions of an equable moist and warm climate assist the treatment; and to the combination of these circumstances with weak but gaseous common-salt-springs, *Soden* owes its reputation in cases of bronchial catarrh, even in those which are complicated with commencing consumption. The power of the chloride of sodium in increasing nutrition and promoting digestion corresponds with the requirements of many of these cases, and the amount of iron in the *Soden* springs scarcely contra-indicates their use in consumptive persons, as any heating effect from the iron is very doubtful, and its constipating effect is counteracted by the carbonic acid and the chloride of sodium. Like *Soden*, all other weaker common-salt-waters can be given, and the choice must be specially regulated according to climatic circumstances.

Tuber-
culosis.

8. *Gout*, as a dyscrasia, requires, as we have repeatedly stated, vigorous treatment, stimulating the retrogressive change of substance, the energetic use of all the forms of warm baths, and lixiviating treatment with pure water, soda-waters, and Glauber's salt waters, among which the latter, and especially the warm springs of Carlsbad, justly enjoy the highest reputation. For common-salt-waters, especially the weaker sort up to Kissingen and Wiesbaden, we reserve those numerous cases in which a wise prognosis relinquishes all hope of cure, and only strives after moderate acceleration of change of substance, at the same time keeping up nutrition. If, however, the retrogressive metamorphosis require to be vigorously accelerated, the physician must be satisfied with the use of Glauber's salt waters, and must not have recourse to strong common salt

Gout.

waters, misuse of which is frequently made, and almost always results in catarrh of the bowels, dyspepsia, and other consequences.

Diseases
of the
bones.

9. *Diseases of the Bones*.—Caries, necrosis, and rachitis require for their removal a new formation of bone, not only a deposit of calcareous salts, but also necessarily the formation of osseous cells with which a secretion of chloride of sodium is always combined. As in most cases, either as a condition or as a consequence of the disease, digestion, sanguification, and nutrition are at a low ebb, common salt fulfils a double purpose; but for this reason it should be taken in small doses and for the most part should be combined with carbonic acid. Generally speaking, courses of drinking are not sufficient, and they must be combined with sool-baths; but when the strong sool which is used for baths is also prescribed to be taken inwardly, instead of the weak and gaseous waters of Homburg, Kissingen, Cronthal, and Canstatt, the prescription is a terrible misuse of the remedy, caused as much by thoughtlessness as by quackery. The above mentioned weak acidulated waters containing common salt are everywhere to be had; and we are ourselves convinced that, if at Kreuznach the Kissingen Ragoczi gushed forth by the side of the strong and gasless Elisen spring, the latter would not be used at all for drinking in order to produce the effect of common salt on the blood.

Scrofula.

10. *Scrofula*.—So far as regards scrofulous diseases in the bones, the remarks just made are applicable. For accelerating the absorption of considerable exudations of the glands, as we have frequently stated, lixivating medicinal waters, from stronger common salt and Glauber's salt springs, may be recommended, and especially the Kreuznach system of baths and mineral waters. In cases of considerable degrees of dyspepsia and catarrh of the stomach and bowels, moderation must, however, be carefully observed, and none but weaker common-salt-waters, and frequently only soda and Glauber's salt waters, may be given.

Exuda-
tions.

11. *Exudations* which are capable of absorption, espe-

¹ See the chapter on the subject in the first book.

cially in the pleura, the peritoneum, and in the subcutaneous cellular tissue, very frequently yield to the moderate use of weaker and gaseous common-salt-waters, as well as to medicinal waters from Glauber's salt springs. The choice may be regulated according to individual circumstances, which either admit treatment that diminishes substance, or forbid it. In *ovarian tumours* and in *fibroids of the uterus*, we have seen as little successful results from common-salt-waters as from other medicinal springs; on the other hand, we have known many a case from our own experience and that of others, in which *chronic infarction of the uterus*, with all its accompanying symptoms, has been essentially improved by careful use of the Kissingen waters; we have seen, however, similar results attending the use of Carlsbad, Franzensbad, and Elster.

THE COMMON-SALT-SPRINGS ORDINARILY USED FOR
COURSES OF DRINKING.

The most important and best known *sool-baths* have been enumerated in the first book, and it only remains for us here to give attention to the drinkable *common-salt-springs* existing at most of them, drinkable partly on account of their slight amount of salt, and partly from the assisting presence of carbonic acid. In many places, it is true, the strong sool used for baths is, as we have mentioned, also used for drinking, but this is a great misuse. Judicious courses of drinking may, however, be arranged by the addition of acidulated waters; our present compendium, however, can only take into consideration the chief natural springs, the effect and constitution of which must serve as a model for similar artificial combinations. These springs have been already for the most part mentioned, namely, Baden-Baden, Canstatt, Soden near Aschaffenburg, Pyrmont, Soden near the Taunus, Neuhaus in Franconia, Cronthal, Schmalkalden, Homburg, Wiesbaden, Bourbonne, Iwonicz, Kreuznach, Kissingen, Mergentheim, Naubeim, Dürkheim, Hall, Adelheidsquelle, and Wildegg. The opportunities for sool-baths that exist in these places have been mentioned in the first book. The most important component parts,

namely the amount of chloride of sodium and that of carbonic acid, are shown in the following tables, precedence being given in the first according to the amount of chlorides, in the second according to that of carbonic acid :

	Chloride combinations.	Carbonic acid.
Nauheim . . .	124	20
Hall . . .	98	5
Dürkheim . . .	88. 96	4
Wildegge . . .	95	2
Homburg . . .	92	48
Kreuznach . . .	90	0
Schmalkalden . . .	80	8
Neuhaus . . .	76	33
Soden (Aschaffenburg) .	40	0
Wiesbaden . . .	57	6
Bourbonne . . .	51	18
Mergentheim . . .	52	13
Soden (Taunus) . . .	19. 27. 106. 117	30. 48
Kissingen . . .	19. 45. 48	41. 48
Iwonicz . . .	47. 60	27. 30
Pyrmont . . .	54	23
Adelheidsquelle . . .	38	13
Cronthal . . .	28	33
Canstatt . . .	15. 19	19. 23
Baden-Baden . . .	17	1

	Carbonic acid.	Chloride combinations.
Kissingen . . .	41. 48	19. 45. 48
Homburg . . .	48	92
Soden (Taunus) . . .	30. 48	19. 27. 106. 117
Cronthal . . .	33	28
Neuhaus . . .	33	76
Iwonicz . . .	27. 30	47. 60
Canstatt . . .	19. 23	15. 19
Nauheim . . .	20	124
Pyrmont . . .	23	54
Bourbonne . . .	18	51
Adelheidsquelle . . .	13	38
Mergentheim . . .	13	52
Schmalkalden . . .	8	80
Wiesbaden . . .	6	57
Hall . . .	5	98
Dürkheim . . .	4	88. 96
Wildegge . . .	2	95
Baden-Baden . . .	1	17
Kreuznach . . .	0	90
Soden (Aschaffenburg) .	0	40

Most of these springs are cold ; three only have a high temperature, namely Wiesbaden and Baden, 69° Cent. (about 156° Fahr.), and Bourbonne, 59° Cent. (about 148° Fahr.).

Some others possess a lukewarm temperature, as Soden, 21·24° Cent. (about 70° to 75° Fahr.); Cannstatt, 17·5° to 20·5° Cent. (63·5° to 69° Fahr.).

Kissingen,¹ 590 feet above the sea, in the pleasant valley of the Franconian Saale, and now connected by railway with Schweinfurt, is the main representative of the cold and moderately strong salt-springs, rich in carbonic acid, the use of which is adapted to most of the cases above mentioned. As in most much-frequented spas, life at Kissingen may be either luxurious or cheap. The most important springs are the well-known Ragoczi and Pandur, and the Maxbrunnen; the latter is a very weak common-salt-water, and no considerable difference exists between the two former, except that the Pandur contains a few cubic inches more of carbonic acid. They contain in 16 ounces:

	Ragoczi.	Pandur.	Maxbrunnen.
Chloride of sodium . grs.	44·71	42·39	17·52
" potassium .	2·20	1·85	1·14
" lithium .	0·15	0·13	0·004
" magnesium .	2·33	1·62	0·51
Sulphate of magnesia .	4·50	4·59	1·82
" lime .	2·99	2·30	1·06
Carbonate of lime .	8·14	7·79	4·62
" protoxide of iron	0·24	0·20	0·0
Carbonic acid . . .	41 (cub. in.)	48 (cub. in.)	41 (cub. in.)
Temperature . . .	10·6° Cent. (about 51° F.)	10·6° Cent.	10° Cent. (50° Fahr.)

It is an advantage in these springs that they only contain from 1 to 3 grains of indigestible sulphate of lime. [On Liebig's suggestion also, a *bitter-water* is now prepared from the sool, and is very similar to the Friedrichshall water in its chemical constitution.—Drs. O. Diruf, sen., E. Diruf, jun., Erhard, Welsch, sen. and jun., and several other physicians.]

Homburg, on the southern declivity of the Taunus, Homburg. 600 feet above the sea.

The springs used for courses of drinking have the following composition (grains in 16 ounces) according to Fresenius:

¹ Respecting the baths, see p. 220.

	Elisabethenbrunnen.	Kaiserbrunnen.
Chloride of sodium	75·7	55·1
„ potassium	2·6	1·9
„ calcium	5·28	4·2
„ magnesium	5·6	3·2
Sulphate of lime	0·1	0·1
Carbonate of lime	11·6	7·1
„ magnesia	0·2	0·3
„ protox. of iron	0·18	0·18
Carbonic acid	45 (cub. in.)	55 (cub. in.)
Temperature	10° Cent. (50° Fahr.)	11·2° Cent. (about 52° Fahr.)

The more generally used Elisabethenbrunnen is accordingly much stronger than the principal springs of Kissingen, and the Kaiserbrunnen is likewise somewhat stronger, and contains, moreover, a great amount of carbonic acid. The effect is, therefore, stronger than at Kissingen, and smaller doses are required. Respecting the baths, see page 212. Homburg is reached by railway from Frankfurt in half an hour.

[We may direct attention to the suitability of the ‘Luisenbrunnen’ to some cases of anæmia and Indian cachexia, by its smaller proportion of all chlorides, and almost entire absence of those of calcium and magnesium; and to the ‘Ludwigsbrunnen,’ which likewise contains scarcely half the amount of chlorides found in the Elisabethenbrunnen and Kaiserbrunnen.—Drs. Aug. Becker, Deetz, Friedlieb, Hoeber, Lewis, Weber, and other physicians.]

Pymont. *Pymont*¹ has, in addition to its chalybeate springs, salt-springs, one of which is used for drinking and is well adapted for moderate courses of treatment. This spring contains in 16 ounces:

Chloride of sodium	54 grains.
Carbonate of lime	10 „
Sulphate of magnesia	7 „
„ lime	6 „
Carbonic acid	23 cubic inches.
Temperature	10° C. (50° F.)

The Pymont salt-spring is about equal to the Kissingen springs in its amount of salt, but in many cases is to be

¹ See the chalybeate springs; also see p. 232.

preferred on account of its smaller and yet more than sufficient amount of carbonic acid.

*Nauheim*¹ forms, with *Rehme*, the group of gaseous thermal sool-baths, and in addition to its strong bath-springs it has two drinkable springs, the Kurbrunnen and the Salzbrunnen, the analyses of which (p. 251) have been stated with those of Homburg, Kissingen, and the Kreuznach Elisenquelle. A diluted Kurbrunnen and a diluted Salzbrunnen are also taken, and are formed by means of a weak but gaseous salt-spring. Beneke introduced these dilutions, in order, for very numerous cases in which the Nauheim springs are too strong and produce dyspepsia and catarrh of the bowels, to obtain an amount of salt which should be about in proportion with the tested amount at Kissingen. This is one of the unfortunately still rare instances of a rational use of the remedy afforded. At many spas, where strong salt springs exist, the attempt is made to weaken their excessive local effect by diminishing the doses, whilst, on the contrary, a diminution of the concentration is required.

Nauheim.

*Iwonicz*² has two springs similar to those of Kissingen, and containing small quantities of iodine and bromine.

Iwonicz.

Neuhaus, in Franconia,³ has several springs, the weakest of which, the Elisabethquelle, stands midway between Kissingen and Homburg, and is therefore adapted for those patients who from individual requirements prefer a quiet, simple, and cheap life in the country to the bustling Kissingen. (Drs. Billmann and Faulhaber.)

Neuhaus.

Soden, on the Taunus,⁴ possesses a great abundance of springs, which, all of them rich in carbonic acid, vary between 18 and 109 grains in their amount of common salt, and consequently are adapted for all the general and individual conditions assigned to common salt waters; they have an advantage in many cases in their lukewarm temperature, while the amount of iron is scarcely to be taken into consideration. In the weak springs, which afford more prospect of absorption, there is very little

Soden, on
Taunus.¹ See p. 235, *et seq.*² See p. 216.³ See p. 213.⁴ See p. 213.

iron, and the somewhat larger amount to be found in the stronger ones is probably removed by the intestines with the salt. In the treatment of chronic catarrhal conditions, with or without tendency to phthisis, besides the effect of common salt, the favourable climate has to be taken into account, as the warmth, equability, and moistness of it essentially assist the effect of the water; only sick persons, who require refreshment as well as quiet, should avoid the hot weeks, and should choose the fine spring, late summer, and autumn for their visit.

The composition of the springs is (grains in 16 ounces):

	I. Müch. brunnen.	II. Warm- brunnen.	III. R. Schwefel- brunnen.	XVII. Wiesn- brunnen.	VI. A. Willhelms- brunnen.	IV. Esel- brunnen.
Chloride of sodium . . .	18.62	26.31	77.36	94.55	104.10	109.30
Sulphate of lime . . .	0	0	0.60	0.83	0.98	0.69
Carbonate of magnesia . .	2.15	2.90	1.20	1.42	1.28	1.09
„ lime . . .	3.52	4.90	7.19	8.37	8.38	10.08
„ protox. of iron . . .	0.06	0.09	0.21	0.21	0.30	0.11
Carbonic acid . . .	Cub.in. 31	Cub.in. 33	Cub.in. 40	Cub.in. 42	Cub.in. 48	Cub.in. 29
Temperature in Cent. . .	24.5°	23°	17°	15°	21°	
„ in Fahr. . .	76.1°	73.4°	62.6°	59°	69.8°	

[Soden has now the advantage of the well-situated and more bracing health-resort, *Falkenstein*, in its immediate neighbourhood. Falkenstein, about 1,700 feet above sea-level, is intended as a summer and winter health-resort for the treatment of the earlier forms of phthisis, and some other chronic pulmonary affections. The place is well sheltered from north and east winds by the Taunus range of mountains, on the slope of which it is situated. There is much wood in the neighbourhood, offering shelter from sun and wind, and thus allowing open-air exercise during the greater part of most days.—Drs. Köhler, Pagenstecher, Georg Thilenius, O. Thilenius, and others.]

Mergen-
theim.

Mergentheim, situated in the pleasant and mild valley of the Tauber, in Würtemberg, railway station between Würzburg and Heidelberg, 590 feet above the sea, has a cold spring, which, in addition to a very moderate amount of carbonic acid, contains 51 grains of common salt, and

also a considerable quantity of Glauber's and Epsom salts, and hence may be regarded partly as a common-salt-water and partly as a bitter water. The baths, with their $\frac{2}{3}$ per cent. of common salt, can only be considered as very weak sool-baths.

Chloride of sodium	51.26 grains in 16 ozs.
Sulphate of soda	21.89 "
" magnesia	15.88 "
" lime	9.86 "
Carbonate of lime	5.45 "
" magnesia	1.40 "
" protoxide of iron	0.05 "
Carbonic acid	13 cub. in.
Temperature	11° C. (51.8° F.)

[By concentration of the *Carlsquelle* a bitter-water has of late years been prepared, which has about the same amount of sulphates of magnesia and soda as Friedrichshall, but double the quantity of common salt, and more sulphate of lime.—Drs. Ellinger, Horing, sen. and jun.]

*Schmalkalden*¹ has a spring containing 71 grains of common salt, and the small but still very effective quantity of 8 cubic inches of carbonic acid; it contains, however, 22 grains of sulphate of lime, by which it is rendered rather indigestible.

Schmal-
kalden.

The *Adelheidsquelle*² is usually described as an iodine-water, and has, as such, been mentioned in the first chapter. We repeat that we do not believe in the effect of minimal doses of iodide of sodium in mineral waters, since the empirically tested doses contained in corresponding pharmaceutical preparations amount to 20 times as much. But the spring, apart from its amount of iodine and bromine, is valuable as a very pure and mild common-salt-water, combined with a very slight amount of carbonic acid, 9 grains of bicarbonate of soda and 38 grains of chloride of sodium. It is accordingly an acidulated alkaline-muriatic water, and shares the indications common to this group and to weak common-salt-waters.

Adelheids-
quelle.

Cannstatt.³—This spa possesses several springs well adapted to cases requiring the slightest effect. They

Cannstatt.

¹ See p. 214.

² See p. 215.

³ See p. 212.

contain no more common salt than Selters water, with a sufficient amount of carbonic acid, and instead of carbonate of soda, carbonate of lime which acts as a remover of acidity; also a small amount of Glauber's and Epsom salts, which gently act upon the bowels, and lastly, moderate quantities of iron, the absorption of which is not prevented by any considerable amount of salt. We give the analysis of the weakest and the strongest springs, the temperature of which amounts from 17.5° to 20° Cent. (63.5° to 68° Fahr.).

	Salzrainquelle.	Weiblein.
Chloride of sodium . . .	15.44 grs. in 16 ozs.	19.50
Carbonate of lime . . .	8.12 ..	7.38
" protox. of iron . . .	0.09 ..	0.25
Sulphate of soda . . .	2.95 ..	4.75
" magnesia . . .	3.86 ..	2.25
" lime . . .	6.53 ..	7.75
Carbonic acid . . .	23 (cub.in.)	19 (cub.in.)

(Drs. Kiel, Ruhle, Tritschler, Wadelin.)

Cronthal.

*Cronthal.*¹—The two springs of Cronthal represent the purest acidulated common-salt-waters, with the exception of carbonate of lime; all the other component parts exist in but minimal quantities. The climate is mild, and the mode of life simple.

	I.	II.
Chloride of sodium . . .	22.27 grs. in 16 ozs.	27.20
" potassium . . .	0.77 ..	0.67
Carbonate of lime . . .	4.17 ..	5.10
Sulphate of lime . . .	0.21 ..	0.23
Carbonate of magnesia . . .	0.72 ..	0.72
" protoxide of iron . . .	0.05 ..	0.1
Carbonic acid . . .	30 (cub.in.)	44 (cub.in.)
Temperature . . .	13.8° Cent. (56.8° Fahr.)	16.2° Cent. (61.1° Fahr.)

Baden.
Baden.

*Baden-Baden.*²—This spring is likewise very pure; it contains in 16 ounces only 16½ grains of common salt, therefore scarcely so much as Selters water, only minimal component parts of other salts, also of iron (0.03) and only half a cubic inch of carbonic acid, which is as good as

¹ See p. 213.

² See p. 211.

nothing. The high temperature, 67° Cent. (152·6° Fahr.) is another essential property, promoting as it does the rapid absorption of the chloride of sodium; but it also limits the extent of the common salt, because it is but seldom that a person can bear such considerable quantities of very warm water as would be required to produce any great effect from the salt. The want of carbonic acid especially concerns the local effect on the stomach. The mineral waters at Baden seem therefore somewhat slight in their effect, and in the same way the baths can only be regarded as indifferent thermæ; to the latter, as well as to the soothing climate and the splendid spa life and general arrangements, Baden owes much of its reputation.

[To the minute quantities of lithia in two different springs the author refers at another place (p. 478). We agree with him that they cannot be held responsible for any of the effects of Baden.—Drs. Berg, Biermann, Frech, Gaus, Heiligenthal, Müller, Seligmann, Schrauder, Wilhelmi.]

Hall, in Austria—respecting the baths of which, as well as the iodine effect of the famous goitre-water, we refer to page 226—possesses for internal use a strong common-salt-water (93 grains), with only 5 cubic inches of carbonic acid; hence it easily excites dyspepsia and vomiting, symptoms which have often been erroneously ascribed to the effect of the iodine, even in doses of 6 ounces. Its composition is :

Hall, in
Austria.

Chloride of sodium	93·46	grs. in 16 ozs.
„ potassium	0·30	„
„ magnesium	1·49	„
„ calcium	3·07	„
Bromide of magnesium	0·44	„
Iodide of magnesium	0·32	„
Carbonate of protoxide of iron	0·03	„
Carbonic acid	7	(cub. in.)

Dürkheim.¹—The water, on account of its great amount of chloride of calcium and its small amount of carbonic acid, is heavy of digestion, and being absorbed with difficulty it readily produces catarrhal diarrhœa.

¹ See p. 232.

The climate and the amount of sool, however, afford the means at Dürkheim for excellent sool-bath treatment.

Wildegg.

Wildegg.¹—The same may be said of this spring as we have just said of Dürkheim. Instead of chloride of lime, sulphate of lime here preponderates, and the water is in consequence equally heavy of digestion.

Soden,
near Asch-
affen-
burg.

Soden, near Aschaffenburg,² possesses, besides its 2 per cent. spring for baths, a spring for drinking, of average value (40 grains of chloride of sodium, and 18 grains of chloride of calcium), but without any carbonic acid. It can be given in smaller doses for the purpose of producing a moderate effect of common salt.

Kreuz-
nach.

Kreuznach.³—We have mentioned on several occasions that the advantage and reputation of Kreuznach do not proceed from the constitution of its springs, but from the system which has been established there of treating scrofulous cases with the external and internal use of sool. This system consists in the combination of strong sool-baths with courses of waters, the latter taken all the more strongly, the more a rapid absorption of scrofulous exudations is required; and all the more mildly, the more a generally stimulating effect is indicated. The *Elisenquelle*, which is most used for drinking, contains 91 grains of chlorine combinations and no carbonic acid; and when it is taken in considerable doses, an effect is always perceived in the increased secretions of the bowels. We prefer, however, from manifold experience a weaker but gaseous common-salt-water, such as *Kissingen*, and we have frequently, moreover, found the *Carlsbad* water still more efficacious for the purpose of rapid absorption of exudations; and we are firmly convinced that the *Elisenbrunnen* would never be given internally at Kreuznach, if springs existed there such as the *Kissingen Ragoczi* and the *Carlsbad Sprudel*. It is true the *Elisenbrunnen* possesses a considerable amount of the effect of common salt, but its constitution renders it not a remedy to be taken in average cases; and it is necessary for the practitioner, while he recognises the good

¹ See p. 216.

² See p. 213.

³ See p. 216.

generally, to perceive what is still better. Our doubt as to the effect of iodine we have frequently expressed. The Elisenquelle contains in 16 ounces :

Chloride of sodium	72·88 grains.
„ calcium	13·39 „
„ magnesium	4·07 „
„ potassium	0·62 „
„ lithium	0·61 „
Bromide of magnesium	0·27 „
Iodide of magnesium	0·03 „
Carbonate of lime	1·69 „

The utter absence of sulphate of lime is an advantage, which has to be taken into consideration as regards the local effect on the stomach.

(Drs. Engelmann, Jung, Lossen, Prieger, Röhrig, Stabel, Strahl, Trautwein, at Kreuznach; and Dr. von Frantzius at Munster-am-Stein.)

Wiesbaden.¹—The Kochbrunnen, 69° Cent. (156° Wiesbaden. Fahr.) warm, contains in 16 ounces :

Chloride of sodium	52·49 grains.
„ potassium	1·12 „
„ lithium	0·001 „
„ calcium	3·61 „
„ magnesium	1·56 „
Bromide of magnesium	0·02 „
Sulphate of lime	0·69 „
Carbonate of lime	3·21 „
„ protoxide of iron	0·04 „
Carbonic acid	6½ (cub. in.)

The amount of common salt slightly exceeds that of Kissingen, and nevertheless the effect of increased secretion of the bowels much more rarely occurs, and larger quantities can be drunk at Wiesbaden than at Kissingen. The reason for this lies partly in the rapid absorption of the common salt occasioned by the high temperature, and partly in the small amount of carbonic acid, which is not sufficient to excite strongly the peristaltic action. Thus the general differential indication for their use is as follows. 1. The warm spring of Wiesbaden is to be preferred, when the strong effect of the common salt

¹ See p. 214.

upon the blood is required, presupposing that the individual condition of the stomach does not prohibit the warmth and does not demand the stimulant of cold. 2. Not only in the latter case, but generally speaking wherever a more energetic stimulation of the mucous membrane and muscles of the stomach is desired, cold and gaseous springs are to be preferred; and as a rule a smaller amount of salt in these latter is sufficient, because the local effect of the carbonic acid and of the cold intensifies that of the chloride of sodium. From our own experiments, we find that a gasless salt-water of the temperature of the Kochbrunnen may contain double the amount of chloride of sodium, without so strongly exciting the secretion of the stomach and bowels, as the same quantity of the Kissingen Ragoczy.

**Bour-
bonne.**

*Bourbonne*¹ is, as regards baths and waters for internal use, the French Wiesbaden, and like this it is much frequented. Chloride of sodium, 46 grains; carbonic acid, 6 cubic inches. Temperature, 59° Cent. (138·2° Fahr.).

Mondorf.

Mondorf, in the Grand Duchy of Luxembourg.²

¹ See p. 215.

² See p. 216.

CHAPTER VI.

THE INTERNAL USE OF SULPHUR-WATERS.

IN the introduction to the Sulphur-Baths (page 266 *et seq.*) it was mentioned that not only for the external but also for the internal use of sulphur-water there was a lack of all accurate information which could distinctly prove the physiological effect of sulphuretted hydrogen and explain the clinical facts respecting it. The effect of these waters certainly, so far as no other component parts come into consideration, depends on sulphuretted hydrogen; and the sulphurets also only produce an effect by their oxydation and partial transformation into sulphuretted hydrogen. Poisoning from sulphuret of potassium exhibits the same symptoms as poisoning from sulphuretted hydrogen, and in the one as in the other the gas escapes from the lungs.

The appearances of the strong effect produced by sulphuretted hydrogen, as they have been observed in cases of accidental poisoning and in experiments on animals, namely, general discomfort, trembling, faintness, giddiness, and at last chronic convulsions and delirium, accompanied with a slackening of the pulse, have never been seen to attend any medicinal use of the ordinary sulphur-waters, but only, and this in a slight degree, the inhalation of the gas of the springs. If, however, the inhalation system is not by any means so constantly used as the drinking system, and hence an empirical and doubtful conclusion is arrived at regarding the effect of the power; the reason probably lies in the fact that the inhaled gas is very rapidly exhaled by the lungs without influencing the blood, while the gas received in the water drunk reaches the portal vein directly and can there produce its effect. This

Effect of
sulphu-
retted
hydrogen
on the
blood of
the me-
senteric
vein.

effect of sulphuretted hydrogen on the portal vein seems for the present the only handle for an admissible theory. It emanated from Weilbach; it was established by Roth, and has been adopted by Schoenlein. The observations relate for the most part to simple hyperæmic enlargement of the liver, frequently combined with catarrh of the lungs and phthisis; and the author, who, twenty years ago, suffered from considerable hemoptysis, in consequence of hemor-rhoidal enlargement of the liver, and who found the enlargement subside at Weilbach, is able to confirm them as a personal witness. The facts relating to the matter are as follows.

1. Generally speaking, the Weilbach water has rather a constipating than an aperient effect; the fæces become firmer, intercurrent diarrhœa arises from casual irritation of the intestinal membrane, and as a rule is not desirable as regards the general good effect; at any rate, the water does not act, like Glauber's salt waters, by increasing the intestinal secretions.

2. The water does not by any means excite that fresh feeling in the stomach which we know as the direct effect of cold acidulated and saline waters, and which shows itself in keen appetite and real desire for food, but in the course of the treatment it excites real *hunger*.

3. The good and progressive effect in the diminished swelling of the liver is accompanied by a darker and at length black colouring of the fæces, in which a large amount of sulphuret of iron is found. The iron in this combination does not proceed from the water, which contains no iron at all, but either from the food or from the blood. In favour of the latter assumption we find that—

4. Conjointly with the decrease of the liver an anæmic condition manifests itself, in spite of plentiful nutrition, frequently requiring a subsequent course of steel-waters. This appeared in the case of the author.

The conclusion which Roth draws from this fact is, that the sulphuretted hydrogen is transmitted by diffusion directly into the blood of the portal vein, and there combines as sulphuret of iron with the iron of the decaying blood-corpuscles, and thus destroys them. This theory accords with the effect of sulphur on the ejection of

metallic poisons, in which hitherto a direct combination of the sulphur with the metals has been supposed, and for the explanation of which an increased moulting of the cells in the liver is sufficient. The liver, however, is well known to be the main *dépôt* of retained metallic poisons.

In these facts and in the corresponding theory rest the only positive indications for the use of sulphur-waters, and these are justified by physical experience and physiological considerations, viz.: 1. The indication of their suitability in those cases of bronchial catarrh and phthisis which are accompanied by hemorrhoidal enlargement of the liver and by sluggish circulation in the portal vein; 2. The indication for their use in cases of abdominal stasis generally; 3. The indication for their use in cases of chronic metal poisoning. We have little certain material on which to base an accurate investigation of these indications, or an explanation of the choice between sulphur-waters and other systems of treatment.

1. *Bronchial Catarrh and Phthisis*.—The cases which the author noticed at Weilbach were accompanied with enlargement of the liver or hemorrhoidal conditions. The effect of the sulphur-water is here probably a general one, proceeding from the blood of the portal vein, which, according to the above theory, the sulphuretted hydrogen unloads, thus creating room for the formation of new and healthy cells. In addition to this, the quieting effect produced on the heart may perhaps be mentioned, for a certain diminution of the pulsation is to be observed in most cases of poisoning; but it is difficult to prove this through the usual courses of waters, owing to the increased exercise, and in many spas to the high temperature of the water. Lastly, it is very probable, as the gas is predominantly ejected from the lungs, that a local effect on the mucous membrane of the lungs is produced by it, but for the present we lack all basis for a more exact explanation. The inhalations which have been tried, especially for the latter purpose, are a very doubtful remedy; because this form of its introduction is most rapid in its poisoning effect; frequently, moreover, in inhalation an irritating and not a quieting effect is perceived—spasmodic coughing, dyspnoea, and accelerated pulsation.

Bronchial
catarrh
and
phthisis.

It is for the present impossible to draw an exact *alternative* between the use of sulphur-waters and the more general one of soda and common salt waters in cases of bronchial catarrh; all that the author knows on the matter is the advantage which, from personal experience, he ascribes to sulphur-water in those catarrhs which are accompanied with well-marked hemorrhoidal constitution, and especially with hyperæmic enlargement of the liver. The successful results brought forward in the special literature on the subject are not, however, sufficient to prove the effect of the sulphur; partly because in some springs, such as Aix-la-Chapelle, chloride of sodium is given in strong doses; partly because many, and especially highly situated sulphur-springs and those containing the smallest amount of sulphur, are warm and are taken warm. Warm water, however, is in itself a powerful expectorant. The high position of the Pyrenean springs has especially to be taken into consideration, in estimating the successful results attending their use in cases of persons suffering from diseased lungs.

That sulphuretted hydrogen has a *direct anticatarrhal effect*, like soda and chloride of sodium, is much to be doubted. The investigation of the question, however, must be made with low situated and cold sulphur-springs, in which neither the high temperature nor the amount of salt in the water nor the high position of the place, as concurring influences, can obscure the observation. With respect to phthisis, we can only say that at Weilbach we have observed several cases of cavities, accompanied with hemorrhoidal enlargement of the liver, which have been relieved as regards the latter symptom, and the progress of which has been retarded for a considerable time by repeated courses of waters. During the treatment a slight anæmia appears, but it soon yields to a strong meat diet.

2. *Chronic Catarrh of the Pharynx*.—Recommended by Rühle.

Stasis in
the mesen-
teric
system.

3. *Stasis in the Portal System*.—Although the theory of the direct effect of sulphuretted hydrogen relates to the blood of the portal vein, yet even this most general indication for the use of sulphur-waters is scanty as to precise and discriminating conditions. The question be-

tween soda, common salt, and Glauber's salt waters on the one side, and sulphur-waters on the other, must first be solved; in fact, it has first to be investigated. As the matter stands, we can only say that the former group of mineral waters is used much more frequently, and that sulphur-waters have only a few advocates, who, encouraged by special experience, have gained confidence in the remedy. The author belongs to these advocates; but the summary of his observations is limited to a few statements.

(1.) The functions of the stomach must have a certain amount of health in order not to be affected dyspeptically by the sulphur-water. (2.) The decrease of the hyperæmic liver *without* artificially increased secretion of the bowels affords in many cases a more welcome course than when a condition of diarrhœa, however moderate, is kept up by other waters. (3.) Although it is to be hoped that numerous and accurate observations will establish a distinct physiological and clinical alternative, yet in many cases the general principle seems to hold good, namely, that the organism makes use of very different means for the same object, and that the loss of blood-corpuscles may have the same final result as that produced by the albuminous secretions attending the use of other remedies. (4.) The anæmic condition which accompanies a successful course of sulphur is not to be feared, as it seems to prepare the way for the rapid reproduction that readily follows the treatment, and which may be assisted by a subsequent course of iron. (5.) Every vigorous course of sulphur-waters must be accompanied with strong meat-diet, such as has been introduced at Weillbach, after Roth's example.

4. *The treatment of chronic metallic poisoning by* Metallic
poisoning.
means of sulphur-waters, especially warm ones, containing common salt, falls under the head of the lixiviating modes of treatment demanded in such cases, and mentioned more fully at page 73, when speaking of the effect produced by the plentiful use of water. The formerly current supposition as to the direct combination of the sulphur with the deposited metals has never been proved; the theory of the effect of sulphuretted hydrogen on the blood of the portal vein is, however, not unsuited to explain the anti-

toxic effect, and this all the more as the liver is known to be the main depôt of retained metal molecules. We must not, however, conceal the fact that even at the present day important voices raised a doubt as to the specific effect of sulphur in cases of metal diseases.

The Chemical Constitution of Ordinary Sulphur-Springs.—In addition to the sulphuretted hydrogen, special importance is attached to the amount of hepar sulphuris contained in the springs, and which appears as sulphuret of calcium, sulphuret of sodium, and sulphuret of magnesium. Although from experiments on animals and cases of poisoning the sulphuret of potassium probably only produces an effect by developing sulphuretted hydrogen, plentiful opportunity for which is afforded in the juices of the digestive canal and in the blood, still the amount of sulphuret of sodium in the various springs is so small, and moreover so various, that the calculation of this agent is very doubtful. The sulphates also are supposed to have their share in the effect produced, as they likewise become partly decomposed and develop sulphuretted hydrogen. The formation of this gas by sulphates in the *blood* has never been observed, and it is also highly improbable; but in the *intestinal canal*, where sulphates certainly very frequently develop sulphuretted hydrogen, this gas is rarely absorbed, but it passes away with other gases of the intestines. It is only in prolonged obstruction of the intestinal canal that we observe the appearances of the diffusion of gas, for instance, in pelvic tumours, which press upon the rectum. The formation of sulphuretted hydrogen from sulphur-waters is at all events possible in the intestinal canal; and it is perhaps to be explained by the combination of a considerable amount of silica with sulphates and sulphurets, and from this the possibility arises that the water after its introduction into the stomach acquires a stronger amount of gas than it originally brought with it; but this is only a possibility, which, moreover, cannot be supported by distinct figures and doses.

A considerable amount of *sulphate of lime* renders the water difficult of digestion; and large and effective

quantities of carbonic acid do not appear in sulphur-waters, and it is only in some springs, namely, at Aix-la-Chapelle, Burtscheid, Mehadia, Baden in Switzerland, (Harrogate in England, and Llandrindod in Wales,) that chloride of sodium exists in effective quantities; in these the effects of the common salt are accordingly combined with that of the sulphur, gentle effects, it is true, corresponding with the small proportions.

In the first book we have mentioned the different sulphur-springs, and have touched upon their respective local relations. It only therefore remains for us to give a tabular summary of their analyses for the appreciation of courses of drinking, and to state the most important principles which ought to guide the use of the table.

1. Waters containing traces or minimal quantities of sulphuretted hydrogen cannot be chosen for those medicinal purposes in which the specific effect of the sulphuretted hydrogen is required, as in the three classes of cases mentioned above.

2. The amount of common salt in some springs, combined with the effect of the sulphur, may produce that of chloride of sodium, and the reputation of these springs rests probably in a great measure upon this property; all the more, as the three indications for the use of sulphur-waters belong also to the weaker common-salt-waters, and, moreover, the high temperature of the majority of these few springs tends to the absorption of the chloride of sodium.

3. The effect of the very weak but highly situated thermæ of the Pyrenees arises from their high situation, the indifferent thermal nature of their baths, and the general and local effect of the warm water; only a few of them contain an amount which admits the possibility of the effect of sulphuretted hydrogen.

4. The very great amount of sulphuretted hydrogen, as much as 6.5 cubic inches, in the springs of Töplitz, Grosswardein, and Harkany, is probably an error, and the analyses proceed from unknown chemists.

5. Generally speaking, the calculation of the sulphuretted hydrogen is arbitrary and is subject to great

[illegible]

variations, and therefore the figures respecting it in the table are of no absolute value, but only serve for approximate comparison.

The *Gutiquelle* of the *Kainzenbad*¹ may be added to the strong sulphur-springs, and it merits the attention of physicians on account of the height of the situation and the climate. The amount of sulphuretted hydrogen is double as great as at Weilbach, and bicarbonate of soda predominates over the other component parts; it contains but little carbonic acid; sulphate of potash, 0.335; sulphate of soda, 0.420; chloride of sodium, 0.189; bicarbonate of soda, 3.967; silica (important in the formation of sulphuretted hydrogen), 0.092; sulphuretted hydrogen, 0.137 = 3.9 cubic inches; organic matter, 0.372. An iron-spring at the same place has not yet been analysed.

¹ See p. 354.

CHAPTER VII.

EARTHY MINERAL WATERS, I.E. THOSE CONTAINING LIME.

HUMBLE and obscure as is the corner which earthy mineral waters occupy in balneotherapeutic compendiums, so imperfect is also the little which this chapter contains of physiological and clinical facts; and if hitherto, frequently, perhaps, from a kind of love of peace, old and new prejudices have been spared, we cannot venture in our compendium, in which above all the distinction between known and supposed effects, is aimed at, to assign to this chapter any other purport than the disclaiming of a few thoughtlessly tolerated assertions and theories.

Theory of
the effect
of lime.

The current theory of the effect of lime is derived from agricultural chemistry: the change of substance in plants is connected with the soil in which they grow; the immense and soil-exhausting cultivation of plants necessarily requires the periodically recurring compensation of worn-out materials, and among these the phosphates of potash and lime. The animal organism also requires lime in addition to other minerals, and this appears in all animal tissues and juices, and especially in the bone-tissue it forms the foundation of a firm condition of cohesion. In rachitis and osteomalacia the bones are found defective in lime, and the theory at once suggests itself that, in the first place, these diseases are caused by this loss of lime, and that, in the second place, they can be cured by an increased supply of lime. This theory appeared very clear and simple at a time when the dawn of physiological chemistry cast a bright light upon every new fact in the eyes of the practical dilettante; but since then (and scarcely twenty years have elapsed) it has not held its ground against advancing physiological science, nor even against sober clinical observation.

So long as men take food, be it what it may, so long is there no lack of the supply of lime. If the calcareous salts in the bones become absorbed, they must previously be in a state of solution, and this can only take place from an excess of acidity, probably from lactic acid; if in this case the solution is to be prevented, this cannot be done by immense supplies of lime, but only by neutralising the acidity, and therefore by supplying some alkaline carbonate in order to increase the alkalescence of the blood. If, however, the softening of the bones proceed from deficient deposit of the bone-earth, even in this case the excessive supply of this substance—apart from the fact that this could scarcely be locally achieved—cannot accomplish the object; for it is not the chemically speculating physician who deposits the lime, like some manuring agriculturist, but the *cells of the bones*, and these under all circumstances find in all the articles of food the material required, but they cannot make use of it because they are diseased. These three statements express the groundlessness of the theory; we will not enter more closely into it, or compare it with the results of clinical practice.

Ground-
lessness of
the theory.

The *sources of the supply of lime* are vegetable and animal food and water. In *animal food*, apart from the bones which contain some carbonate of lime besides the phosphate, it is exclusively phosphate of lime that appears, and this probably chemically combined with different protein substances. How important this source of supply is, is evident from the amount of lime in the substance of the muscles, which contains in a dry state 1 per cent; besides this, however, phosphate of lime appears in every tissue and in every animal fluid. In *vegetable food* also, the lime is in part, though in but a small part, contained as phosphate of lime, the greater portion being combined with vegetable acids to form vegetable salts, from which the organism obtains carbonate and phosphate of lime; and lastly in water, both in spring and river water, there is almost always carbonate of lime, for the most part in a quantity which may very well be taken into account in the supply of lime. The *human body*, with its mixed food, makes use of all the three sources mentioned, and one may, if necessary, take the place of the other.

toxic effect, and this all the more as the liver is known to be the main depôt of retained metal molecules. We must not, however, conceal the fact that even at the present day important voices raised a doubt as to the specific effect of sulphur in cases of metal diseases.

The Chemical Constitution of Ordinary Sulphur-Springs.—In addition to the sulphuretted hydrogen, special importance is attached to the amount of hepar sulphuris contained in the springs, and which appears as sulphuret of calcium, sulphuret of sodium, and sulphuret of magnesium. Although from experiments on animals and cases of poisoning the sulphuret of potassium probably only produces an effect by developing sulphuretted hydrogen, plentiful opportunity for which is afforded in the juices of the digestive canal and in the blood, still the amount of sulphuret of sodium in the various springs is so small, and moreover so various, that the calculation of this agent is very doubtful. The sulphates also are supposed to have their share in the effect produced, as they likewise become partly decomposed and develop sulphuretted hydrogen. The formation of this gas by sulphates in the *blood* has never been observed, and it is also highly improbable; but in the *intestinal canal*, where sulphates certainly very frequently develop sulphuretted hydrogen, this gas is rarely absorbed, but it passes away with other gases of the intestines. It is only in prolonged obstruction of the intestinal canal that we observe the appearances of the diffusion of gas, for instance, in pelvic tumours, which press upon the rectum. The formation of sulphuretted hydrogen from sulphur-waters is at all events possible in the intestinal canal; and it is perhaps to be explained by the combination of a considerable amount of silica with sulphates and sulphurets, and from this the possibility arises that the water after its introduction into the stomach acquires a stronger amount of gas than it originally brought with it; but this is only a possibility, which, moreover, cannot be supported by distinct figures and doses.

A considerable amount of *sulphate of lime* renders the water difficult of digestion; and large and effective

quantities of carbonic acid do not appear in sulphur-waters, and it is only in some springs, namely, at Aix-la-Chapelle, Burtscheid, Mehadia, Baden in Switzerland, (Harrogate in England, and Llandrindod in Wales,) that chloride of sodium exists in effective quantities; in these the effects of the common salt are accordingly combined with that of the sulphur, gentle effects, it is true, corresponding with the small proportions.

In the first book we have mentioned the different sulphur-springs, and have touched upon their respective local relations. It only therefore remains for us to give a tabular summary of their analyses for the appreciation of courses of drinking, and to state the most important principles which ought to guide the use of the table.

1. Waters containing traces or minimal quantities of sulphuretted hydrogen cannot be chosen for those medicinal purposes in which the specific effect of the sulphuretted hydrogen is required, as in the three classes of cases mentioned above.

2. The amount of common salt in some springs, combined with the effect of the sulphur, may produce that of chloride of sodium, and the reputation of these springs rests probably in a great measure upon this property; all the more, as the three indications for the use of sulphur-waters belong also to the weaker common-salt-waters, and, moreover, the high temperature of the majority of these few springs tends to the absorption of the chloride of sodium.

3. The effect of the very weak but highly situated thermæ of the Pyrenees arises from their high situation, the indifferent thermal nature of their baths, and the general and local effect of the warm water; only a few of them contain an amount which admits the possibility of the effect of sulphuretted hydrogen.

4. The very great amount of sulphuretted hydrogen, as much as 6.5 cubic inches, in the springs of Töplitz, Grosswardein, and Harkany, is probably an error, and the analyses proceed from unknown chemists.

5. Generally speaking, the calculation of the sulphuretted hydrogen is arbitrary and is subject to great

quantity of carbonate of lime, without laying claim to any such effect. Lastly, with regard to sulphate of lime or gypsum, we have already frequently mentioned that it is utterly indigestible and not at all capable of absorption; an amount of 10 grains of gypsum to 16 ounces is heavy for the stomach of most persons, and lessens the effect of the other component parts.

Sulphate of lime is mineral waters.

A glance at the amount of sulphate of lime contained in the usual mineral waters will show that it is just those which contain little or no sulphate of lime that are drunk most frequently and in larger quantities, and that in proportion with the increasing amount of gypsum in the others is the doubtful character of their reputation.

No sulphate of lime is contained in—

The soda-waters of Bilin, Fachingen, Geilnau, Giesshübel, Fellahtal, Vichy, Selters, Gleichenberg, Roisdorf, Salzbrunn, Ems, Luhatschowitz [and Apollinaris].

The Glauber's-salt-waters of Marienbad, Carlsbad, Tarsasp, Füred, Rohitsch, Bertrich, Franzensbad, and Elster.

The iron-waters of Petersthal, Cudowa, Altwasser, Reinerz, Nieder-Langenau, Rippoldsau, Schwalbach, Spaa, Steben, Brückenau, Bocklet, Imnau, and Alexisbad.

The lime-water of Wildungen.

The common-salt-waters of Homburg, Cronthal, Wiesbaden, Baden-Baden, Soden, Nauheim, Ischl, Kreuznach, Dürkheim, Hall, Adelheidsquelle, Krankenheil, and Iwonicz.

The sulphur-waters of Weilbach, Langenbrücken, Aix-la-Chapelle, Burtscheid, Mehadia, Harkany, Abano, and the Pyrenean springs.

A small amount of sulphate of lime is contained in—

1. The bitter waters of Gran,¹ in Hungary, 2 grs.
2. The common-salt-water of Kissingen, 1 to 3 grs.
3. The iron-water of Mushau, 3 to 5 grs.
4. The sulphur-waters of Baden near Vienna, 5 grs.; Pystjan, 4 grs.; Teplitz-Trenczin, 3 grs.; Grosswardein, 2 to 3 grs.; Töplitz Warasdin, 1 to 3 grs.

[¹ The Kis-lévaer spring from the neighbourhood of this town, abounding in springs of a similar character, is said to be one of the strongest sulphate of magnesia waters.]

5. The lime-water of Lippspringe, 4 grs., and Inselbad near Paderborn, $\frac{1}{2}$ gr.

A medium amount of sulphate of lime is contained in—

1. The bitter waters of Püllna, 2 to 6 grs.; Sedlitz, 8 grs.; Saischütz, 10 grs.; Friedrichshall, 10 grs.

2. The common-salt-waters of Mergentheim, 8 to 9 grs.; Bourbonne, 6 grs.; Cannstadt, 6 to 7 grs.

3. The sulphur-waters of Neundorf, 5 to 8 grs.; Schinznach, 6 grs.; Baden in Switzerland, 10 grs.

4. The iron-waters of Pyrmont, 6 to 7 grs.; Driburg, 9 grs.

A strong amount of sulphate of lime is contained in—

1. The bitter waters of Iwanda, 26 grs.; Ober Alap, 14 grs. (both in Hungary).

2. The common-salt-waters of Schmalkalden, 22 grs.; Mondorf, 12 grs.; Rehme, 22 grs.; Reichenhall, 32 grs.; Elmen, 10 to 11 grs.; Wildegg, 13 to 14 grs., and others.

3. The sulphur-waters of Eilsen, 17 grs.; Lubien, 15 grs.

4. The lime-waters of Leuk (Loèche), 12 grs.; Weisenburg, 17 grs.

Carbonate of magnesia also removes acidity, but acts more mildly on the stomach, because it is more readily absorbed than the lime-salts. In many mineral waters it appears in moderate quantities combined with chlorides and sulphates, thus increasing their effect on the intestinal secretions, on account of the aperient effect of the magnesia itself.

Carbonate of lime appears in all spring-waters, river-waters, and mineral waters, which contain carbonic acid. In many spring-waters it amounts to several grains, and in mineral waters it is for the most part combined with carbonate of magnesia, which greatly assists its effect on the acidity of the stomach; in many mineral waters it appears in as great quantities as, and even far greater than, in the few so-called true calcareous waters.

Carbonate of lime is contained in—

1. The lime-waters of Wildungen, 5.4 to 9.7 grs.;

Carbonate
of lime in
mineral
waters.

Lippspringe, 5.2 grs. ; Inselbad, 2.5 grs. ; Weissenburg, 0.8 grs. ; Leuk, 0.3 grs.

2. The soda-waters of Ems and Giesshübel, 1.4 grs. ; Selters, 1.8 grs. ; Fachingen, Geilnau, Vichy, Roisdorf, and Salzbrunn, 2 grs. ; Bilin, 3 grs. ; Gleichenberg, 2 to 5 grs. ; Luhatschowitz, 5 grs. ; Fellahthal springs, 9 grs.

3. The sulphate-of-soda-waters of Carlsbad, 2.3 grs. ; Marienbad, 2 to 4 grs. ; Tarasp, 12 grs. ; Füred, 6 grs. ; Rohitsch, 11 grs. ; Franzensbad, 1.6 grs. ; Elster, 1 gr.

4. The sulphate-of-magnesia-waters of Püllna, 0.7 grs. ; Sedlitz, 8 grs.

5. The iron-waters of Rippoldsau, 11 to 14 grs. ; Petersthal, 10 to 11 grs. ; Krynica, 12 grs. ; Borsék, 5 to 11 grs. ; Reinerz, 3 to 6 grs. ; Cudowa, 3 grs. ; Schwalbach, $1\frac{1}{2}$ to 4 grs. ; Driburg, 15 grs. ; Pyrmont, 10 to 12 grs. ; Spaa, 5 grs. (phosphate of lime) ; Imnau, 7 grs. ; Brückenau, $1\frac{1}{2}$ grs. ; Liebenstein, $4\frac{1}{2}$ grs. ; Liebwerda, $\frac{1}{2}$ gr. ; Niederlangenau, $2\frac{1}{2}$ grs. ; Bocklet, $6\frac{1}{2}$ grs. ; St. Moritz, 5 to 6 grs.

6. The sulphur-waters of Eilsen, Aix-la-Chapelle, and Baden near Vienna, 1 to $1\frac{1}{2}$ grs. ; Lubien, Baden in Switzerland, Weilbach, Nenndorf, and Grosswardein, 2 to 4 grs. ; Trencsin and Harkany, 7 to 8 grs.

Frequently, in the recommendation of various springs, great stress is laid on their different amount of lime. Some are extolled as especially pure, because they contain little or no lime ; others are recommended for rachitis or rachitic complications with other diseases, on the ground of their amount of lime. The first of these assertions very often hits upon the truth, because, next to sulphate of lime, carbonate of lime is most difficult of absorption, and hence it easily overloads the stomach and intestines, as a precipitated powder ; the second assertion is based on the theory discussed above, and is as erroneous as the theory itself. Lastly, some waters, the principal element of which is carbonate of lime, have been as true lime-waters especially brought forward as adapted for cases of rachitis and rachitic tendencies, and two springs have been added to their number, which contain little else than a large quantity of indigestible sulphate of lime ; the former of these are Wildungen and Lippspringe, the latter Leuk and Weissenburg.

Wildungen, 740 feet above the sea, three hours from the Wabern station on the Main and Weser railway, in the principality of Waldeck. Setting aside a tolerably pure steel-spring containing 0.58 grains of bicarbonate of protoxide of iron, and 18 cubic inches of carbonic acid, we will take into consideration the Georg-Victors spring and the Helenenquelle.

	Georg-Victors- quelle.	Helenen- quelle.
Sulphate of potash	0.083	0.213
" soda	0.527	0.107
Chloride of sodium	0.059	8.016
Bicarbonate of soda	0.494	6.494
" protoxide of magnesia	0.019	0.009
Silica	0.150	0.238
Bicarbonate of lime	5.471	9.753
" magnesia. . . .	4.113	10.474
" protoxide of iron	0.161	0.143
Free carbonic acid. . . .	33 cub. in.	34 cub. in.
Temperature	{ 10° Cent. (50° Fahr.)	{ 11.3° Cent. (52° Fahr.)

The first of these springs is a strong acidulated spring, containing an average amount of carbonate of lime and magnesia and a very slight amount of iron; the second is a strong acidulated spring, containing a more considerable amount of the two earthy salts, besides an average quantity of chloride of sodium and bicarbonate of soda, and likewise a small amount of iron. There is a third spring, the Thalquelle, recently investigated, containing 6.67 gr. of chloride of sodium, 10 gr. of bicarbonate of lime, 9.8 gr. of bicarbonate of magnesia, 0.1 gr. of bicarbonate of protoxide of iron, and 33 cubic inches of free carbonic acid. The amount of lime and magnesia contained in the first spring is reached and exceeded by many other acidulated springs, and the second and third alone can be considered as specially strong earthy springs, on account of the 20 grains of lime and magnesia contained in each. The oldest and most frequented spring is, however, the first and weaker one (the Georg-Victors-*quelle*).

At page 330, in speaking of soda-waters as adapted for catarrh of the bladder and gravel, we mentioned the importance of the Wildungen springs. The Georg-Victors-*quelle* is a strong acidulated spring, without carbonate of

soda and with a tolerably moderate amount of lime and magnesia. From the presence of these latter it has a moderate effect on the stomach in removing acidity, and as an acidulated water it has a diuretic effect. The Helenenquelle intensifies this effect by its great amount of earthy substances; and is at the same time an alkaline-muriatic acidulated water, though of the weaker sort; the same may be said of the Thalquelle. As regards their effects in counteracting catarrh of the bladder and uric acid concretions in the kidneys, the diuretic effect of a gaseous beverage must be partly taken into consideration, and partly the effect produced on the alkalinity of the blood, though this in a weaker degree than with strong soda-waters. The Wildungen water, is, therefore, in cases of catarrh of the bladder and concretions in the kidneys, a suitable dietetic remedy combined with courses of the waters of Vichy, Fachingen, Bilin, and Carlsbad, and it is also adapted to be taken by itself in regular courses, though these must be continued for a long time. (Drs. Harnier, von Lingelsheim, Roerig, Stoecker, and others.)

Leuk.

Leuk (Leukerbad, Loèche-les-Bains).—For details respecting it see the first book, page 172. The baths may be considered indifferent, as regards the forms of the thermal system, when used for the usual length of a quarter to three-quarters of an hour. The method of baths prolonged for hours, which is customary at Leuk, has to be rejected in most of the cases adapted for indifferent thermæ; in exanthemata, the amount of sulphate of lime has to be taken into consideration, as it acts as a stimulant when the bath is prolonged, and as the result of this treatment a peculiar pustulous eruption is frequently produced. The Lorenz, or principal spring, is also employed for courses of drinking, which scarcely possess any other importance than courses of hot water. The main component part is sulphate of lime, $10\frac{1}{2}$ gr. to 16oz., and this has here, more than in other waters, a constipating effect, because there are no other component parts in the water which stimulate the secretion of the bowels; and moreover the warm water of 50° Cent. (122° Fahr.) is quickly absorbed. A water of such high temperature and taken in quantities

of from 12 to 48 ounces, must naturally produce a diuretic, diaphoretic, and lixiviating effect; but the mineral amount has nothing to do with this effect, and the sulphate of lime is even an unwelcome addition. This spring contains in 16 ounces:

Sulphate of lime	10·673	grs.
„ magnesia	2·365	„
„ soda	0·399	„
„ potash	0·299	„
Carbonate of protoxide of iron	0·079	„
Carbonic acid	0·12	cup. in.

(Drs. Brunner, Grillet, Mengis, sen. and jun., &c.)

Weissenburg, in the canton of Bern, three miles from Weissenburg. Thun, 2,758 feet above the sea, and situated in a narrow and sheltered ravine, has a spring similar to that of Leuk, with this difference, that the amount of gypsum is still more considerable, and the sulphate of magnesia also appears double in quantity:—

Sulphate of lime	17·22	grs.
„ magnesia	5·68	„
Carbonic acid	0·8	cup. in.

and all other component parts, as at Leuk, in minimal quantities.

The waters, taken internally, are especially famous in cases of bronchial catarrh and phthisis; there is, however, no rational explanation for their effects in the constitution of the water. The high situation and the mild and very moist climate are probably the agents. The lukewarm water of 23·8° Cent. (74·8° Fahr.) may act as a gentle stimulant to the change of substance, and the water with its sulphate of lime may be borne by many a sick person.

[The very sheltered position; the perfect calmness of the air, with rare exceptions, caused by the position of the mountains and the situation of the spa amongst pine trees; the possibility thus given of keeping the invalids the whole day long in the open air; the simple but sufficient diet; the culture of the skin by the baths, unwonted to most of the patients flowing to the place—these are the influences to which the excellent results, especially in cases

of phthisis, often obtained at Weissenburg, are due.—Dr. Mueller.]

Lipp-
springe.

Lippspringe and the Inselbad near Paderborn, both recently much used and extolled in cases of phthisis, present great difficulties to the scientific explanation of empirical experiences, difficulties which become the more invincible the more the pharmaceutic, dietetic, and climatic treatment of phthisis is studied from the most different points of view. How little the amount of lime in the springs affords any basis for physiological explanations and indications, has been already mentioned; the taking and the inhalation of nitrogen is no less doubtful¹; and the only climatic peculiarity is the great moisture of the atmosphere of Lippspringe. To authenticate cures of phthisis is very difficult; improvements and checks to the progress of the malady are as little to be denied of Lippspringe as of climatic treatment of the most different kind. For this reason, and because the accurate meteorological study of climatic resorts and of medical geography has only recently begun, it is for the present impossible to treat the subject in question in a compendium of the kind otherwise than by placing the bare contradictory facts face to face with each other. We shall, therefore, here only give the analysis of the springs, and we refer to the fourth book for the climatic treatment of phthisis. The following is the composition of the springs (per 16 ounces).

	Lippspringe.	Inselbad.
Chloride of sodium . . .	1·888 grs.	5·901 grs.
Sulphate of soda . . .	5·463 "	0 "
" magnesia . . .	2·375 "	0·409 "
" lime . . .	2·223 "	0 "
Carbonate of lime . . .	5·2 "	2·177 "
" protoxide of iron .	0·1 "	0·028 "
Carbonic acid . . .	5 cub. in.	0·12 cub. in.
Nitrogen gas . . .	1·4 "	2·78 "
Oxygen gas . . .	0·17 "	0·38 "

(Drs. Rohden, Wolff, and others, at Lippspringe; Dr. Hoerling, at Inselbad.)

¹ See the second chapter of this book.

CHAPTER VIII.

WHEY-CURES.

WHEY is the serum of milk, which, after the separation of the casein and butter, is left behind as a solution of sugar of milk and salts. When used for a course of treatment, it is as a rule prepared with the pepsine of rennet, and is a semi-transparent greenish-yellow fluid, of a sweet and insipid taste. The thickness proceeds from a small quantity of casein and butter which has not been separated, and which amounts to from 1 to $2\frac{1}{2}$ per cent., according to the greater or lesser care taken in the preparation; in solution, on the other hand, there is from $4\frac{1}{2}$ to 5 per cent. of sugar of milk, and $\frac{2}{3}$ to $\frac{1}{2}$ per cent. of salts, the statements as to the exact proportion of which vary considerably in various analyses.

Constitu-
tion of
whey.

It is not all the salts of milk that pass into the whey; phosphate of lime, phosphate of magnesia, and phosphate of protoxide of iron are for the most part precipitated, by chemical combination with the casein, and nothing but chloride of potassium and chloride of sodium, besides phosphate of potash and soda, remain in solution with the sugar of milk; with the exception, however, of very various though for the most part small quantities of lactates of alkalies, produced by the partial decomposition of the sugar of milk into lactic acid. As the amount of salt in the milk itself in different animals, and in one and the same animal, varies greatly on different days, any standard analysis is impossible, and we can only therefore approximately give the probable amount of salts, and consider that a pound of whey contains about 36 or 40 grains of salts—namely, from 10 to 14 grains of chloride of potassium, from 2 to 3 grains of chloride of sodium, and about

20 grains of phosphates, the latter for the most part phosphate of potash, and to a less extent phosphate of soda, besides 340 to 360 grains of sugar of milk.

Direct
effect.

Whey accordingly may be regarded as a mineral water containing $\frac{1}{2}$ per cent. of chlorides and phosphates, with an addition of 5 per cent. of sugar of milk; and, moreover, from 1 to 2 per cent. of nitrogenous substances. Small quantities of whey are quickly absorbed; larger quantities, i.e., $1\frac{1}{2}$ to 3 pounds, often cause dyspepsia or catarrhal diarrhoea, especially owing to the sugar of milk, as in the case with other food and beverages containing sugar. A careful diet is necessary.

Theory.
Reason-
ableness
of whey.

The theory of the whey-cure has been chemically and physiologically established by Beneke. Beneke's pamphlet, *Die Rationalität der Molkenkuren* (Hanover, 1853), has the merit of having developed the points bearing on the subject, and thus of presenting an accurate view of the matter; nevertheless, the mode of the effect produced is not yet quite clear, and pure whey-cures have become less frequent. At the present day, moreover, there is a more general inclination than before to attribute an essential part of the undoubted results to the accompanying circumstances, especially to the enjoyment of country and mountain air, to diet and psychical influences, and to take these influences into account as essential agents.

Sugar of milk is a somewhat indifferent substance as regards its therapeutic importance. Nothing more is ascertained as to its effect than what may be said of cane-sugar and grape-sugar; namely, a slight quenching of thirst and a slight aperient effect, besides a cooling influence in feverish conditions, in consequence of the importance of sugar as a combustible remedy. The aperient effect of sugar of milk is, generally speaking, somewhat stronger than that of cane-sugar, probably from its partial transformation into lactic acid. But little is known as to the part which digested and absorbed sugar plays in the blood, and, generally speaking, we only know that the infant requires sugar for its thriving, whilst in the adult its place is supplied by amylaceæ, which are, for the most part,

transformed in the digestive tract into sugar. The dyspeptic acidity of children, which is so constantly the cause of acute suffering and scrofulous anæmia, in most cases proceeds from the fact that the digestion of amylaceæ is too early expected from the infant stomach; and in this principally lies the importance of milk-diet and milk-treatment in these cases, as, with the exclusion of amylaceous food, sugar is directly supplied as sugar of milk. Milk and whey cures, when used for adults, have also in part the same significance. Still in many constitutions, owing to the decomposition of the sugar of milk, dyspeptic acidity and catarrh of the bowels are produced.

The *salts* of whey are the real vehicles of the effect. The amount of chlorides and phosphates, in all equal to 0·5 per cent., render them a weak mineral water, which is partly to be regarded as common-salt-water, and partly as a solution of phosphates. These salts in the quantity stated, and in the usual amount of whey daily taken, would scarcely produce an aperient effect, if not assisted by the sugar of milk; but this very combination is the cause why dyspepsia and catarrh of the bowels frequently accompany their aperient effect. An acidulated water with common salt or Glauber's salt, or, like Carlsbad, Marienbad, and others, with both, produces an effect on the serous secretion of the bowels, without troubling the stomach and without producing catarrhal irritation of the bowels. A solution of the salts contained in whey, in water containing carbonic acid in the same proportion as in whey, acts aperiently, according to our experience, only when taken in great quantities; and this by simple increase of the secretions, without any catarrhal irritation of the bowels, and without causing nausea and dyspepsia.

Theory regards whey in two points of view: (1) as a slightly aperient mineral water; (2) as a means of nutrition, containing the component parts of milk with the exception of the fat and casein. The popular denomination 'slight or mild aperient' is not, however, for the most part suitable, on account of the disadvantages stated; stasis of the abdomen is generally better counteracted by common salt and Glauber's salt.

Whey is theoretically designated as an article of food, and the whey-cure as a peculiar *mode of nutrition*, in so far as, by the exclusion of the nitrogenous casein and fat, only the non-nitrogenous component parts of the milk are presented to the blood; and upon this fact especially the whey-cure rests its claim to 'reasonableness,' as a mode of treatment designed to renew and improve the constitution of the juices and tissues by its salts and sugar of milk, without at the same time increasing the nitrogenous component parts, the diminution of which is, on the contrary, the second object of the treatment. This theory would be reasonable if it were not that in their diet the patients at the whey-cure establishments make use of ordinary food. Especial stress is laid on the fact that the salts of whey are the salts of milk, and that their mixture, therefore, is the empirical model of the solution of salt required for nutrition. Nevertheless, quite apart from the fact that some of the salts of milk, such as salts of lime and magnesia, are wanting in whey, this solution is only the typical quantity for an infant, and in no wise for an adult; and it is so only as regards milk as an exclusive means of subsistence, but not when taken with other food.

The practical explanation of the value of whey-cures rests with the following conditions.

1. Custom has for the most part introduced whey-cures for sensitive persons and those needing delicate management, especially for sick people who, from bronchial catarrh, consumption, and so-called florid scrofula, have been deprived of fresh air during the winter. To these, spring and summer air, forest air, and very often a high mountainous situation are afforded, the curative powers of which, experience teaches us, have in many cases been sufficient in themselves to produce the improvement which is generally all that is looked for in such conditions.

2. In these sensitive persons the treatment is usually limited to slight quantities, in order that the digestion and nutrition may be disturbed as little as possible; and where larger quantities of whey are taken, the constantly threatening dyspepsia obliges the sick person to observe all the more a careful and equable diet.

3. To this is added the influence of whey as a watery fluid and as a solution of chlorides and phosphates, as a moderate stimulant of the change of substance, which we may assume from the analogy of similar medicinal waters, but which is in no wise proved by accurate investigations.

4. Courses of mineral waters, which in a similar and authenticated manner promote the change of substance, courses of moderately strong common salt or Glauber's salt waters, which accelerate the retrogressive metamorphosis, but which at the same time preserve the appetite and the digestion, and which thus, from the food taken, supply the assimilation of the phosphates lacking in the waters; these effect that which is expected of whey-cures, and they do so in a more sure and harmless manner, and without producing dyspepsia and catarrh of the bowels.

5. That, nevertheless, whey-cures are proved to be of value, especially in cases of florid phthisis in youthful individuals, is an instance of the fact that, generally speaking, we ought to reform our therapeutic maxims with regard to phthisis, and this in the sense of the older schools, which did not, like ourselves, consider phthisis as a *noli me tangere* for mineral waters. Ever since it has been proved from the most recent data of pathological anatomy, that phthisis and tuberculous diseases are in no wise always identical, that, far rather, phthisis in a great number of cases proceeds from catarrhal pneumonia and subsequent cheesy infiltration, and that for the most part tubercles appear only as a consecutive change; ever since then, the necessity for this therapeutic reform has begun to obtrude itself. Slight anticatarrhal and antiphlogistic modes of treatment, combined with strengthening, or at any rate conservative regimen, have been proved reasonable by the present stage of our science, and have been accompanied with successful results when practised by earlier schools. Setting aside any supposed solution of tubercles, such as partially forms the basis of the whey theory, we must adopt methods which produce the absorption of pneumonic infiltrations, and at the same time increase the vigour of the constitution, in order thus to

protect the sick person from those repeated catarrhal and pneumonic relapses which, from the constant injury to the tissue of the lungs, cause the inflammatory action to proceed to phthisis. Among these methods may be reckoned whey-cures, with their accompanying wood and mountain air and suitable diet, as forming a mild antiphlogistic and saline mode of treatment; but the good results achieved by these, in proportionally rare cases, are afforded also by suitable mineral springs, with which the danger of dyspepsia and catarrh of the bowels is not so easily combined.

6. Most decidedly, however, the mode of treatment is contra-indicated in cases of already existing dyspepsia and catarrh of the stomach and bowels.

7. The clearer the whey is, i.e., the less butter and caseine it contains, the slighter is its dyspeptic effect, and this is still more diminished by its combination with an acidulated water.

8. On the other hand, the very usual dilution and warming of mineral waters, by means of an addition of whey, is to be restricted, as it is only strong acidulated iron and soda-waters that can bear this addition; strong common-salt-waters, and especially those devoid of carbonic acid, when mixed with whey, form a horrible combination, producing sickness and dyspepsia from its very taste.

9. The most usual conditions adapted for the use of whey, such as abdominal stasis, florid phthisis, and inclination to catarrhal pneumonia and bronchial catarrh, are just as well and better met by other remedies; and, in the practical estimation of whey-cures, we must take essentially into account the influence of their accompaniments, namely, country or mountain air, high situation, and the like.

In most of the real whey-establishments, the whey is principally prepared from goat's milk; still the difference between cow's whey and goat's whey is but slight. In some places, sheep's is also prepared, and this differs from the other two, almost only in the fact that it is not

so free from albumen. Falk¹ gives the following analytical survey of these three kinds of whey, from an analysis made by Valentiner :—

	Sheep's Whey.	Cow's Whey.	Goat's Whey.
Water	91·960	93·264	93·380
Albumen	2·130	1·080	1·140
Sugar of milk	5·070	5·100	4·530
Fat	0·252	0·116	0·372
Salts and extractive sub- stances }	0·588	0·410	0·578
	100	100	100

WHEY-ESTABLISHMENTS.

There is scarcely a bathing resort or a spa at which the opportunity is not afforded for drinking whey; and the dilution or warming of mineral waters by the addition of whey is still very popular. The advantage generally conceded to Swiss and mountainous places proceeds partly from the healthful character of mountain air, and partly from the erroneous though wide-spread idea that Swiss and mountain whey is *aromatic*, in consequence of the mountain pasturage. This is not the case, because the aroma, which would likewise be contained in the milk, would evaporate during the boiling of the milk for the preparation of the whey. The preparation of the whey requires nothing more than a little attention and some practice, and good whey can be produced everywhere. Among the best known spas and bathing resorts, the following have at the same special reputation for their whey establishments, namely, *Salzbrunn, Kreuth, Reichenhall, Ischl, Baden* near Vienna, *Liebenstein, Alexisbad, Reinerz, Schlangenbad, Ems, Meran, Montreux, Gleisweiler, Streitberg, Rehburg*, and several others mentioned at various places in this book. Special notice, inasmuch as they have little or nothing to offer in other respects, is due to the whey-establishments in Switzerland, also to Gleisweiler, Streitberg, and Rehburg.

¹ *Die Molken in Obersalzbrunn.* Breslau, 1859.

Rehburg. *Rehburg*, in the Prussian province of Hanover, has besides a cold moderately strong acidulated spring, with two grains of sulphate of lime, three grains of carbonate of lime and 20 cubic inches of carbonic acid. This spring is used both for baths and drinking. Excellent fresh forest air, quiet and yet amusing life. Station Stadthagen, on the railway from Hanover to Minden. (Elevation above sea, about 900 feet.)

Streitberg. *Streitberg*, in Franconian Switzerland, 2 miles from Bamberg, 2 hours from the station of Forchheim, 1,800 feet above the sea.

Gleisweiler. *Gleisweiler*, an hour from Landau in the Palatinate, almost 1,000 feet above the sea, situated in a beautiful valley at the foot of the mountain, with a very mild climate. This is a favourite place of resort both for the whey and the grape cures.

Among the more favourite Swiss whey-establishments, *Interlaken* is 1,730 feet above the sea, *Heiden* 2,490, *Weissbad* 2,320, and *Gais* 2,870, [*Appenzell* 2,400, *Engelberg* 3,200].

There are a great number of other whey-establishments, the mention of which is not necessary for a compendium of this kind.

CHAPTER IX.

THE GRAPE-CURE.

THE grape-cure possesses similar importance to the whey-cure. It conveys to the stomach a complicated solution of salts, combined with a considerable amount of sugar; the latter appears to a much greater extent in the grapes than in whey, from 14 to 30 per cent. The salts, the amount of which varies extraordinarily according to the kind of grape, the soil on which it grows, and the weather, are partly formed by inorganic and partly by organic acids. The former consist of silicates, phosphates, sulphates, and chlorides of sodium, potassium, iron, magnesium, and calcium; the latter especially of tartrates of potash and lime. Besides these, the grape-juice contains from 1 to 2 per cent. of albumen and some gum. The amount of inorganic salts is 24 grains in 16 ounces of grape-juice, that of organic salts is 40 grains in the same quantity, and the sugar is from 2 to 5½ ounces. The *direct effect* of the grape-juice on the stomach is like that of all fruits, only in a greater degree: namely, stimulation of the salivary glands and the nerves of taste; agreeable refreshment and quenching of thirst, and stimulation of appetite; increase of the secretion and of the motion of the bowels, and consequently of defæcation. The latter effect especially is greater than after taking other fruits, on account of the larger amount of salts and of sugar. The larger the quantities of grapes taken, especially with an empty stomach, the more apparent is the effect produced on the bowels; the secretion of the bowels is more copious, and is frequently accompanied with catarrhal irritation. Water and albuminous serum are plentifully discharged, the blood in consequence becomes poorer in albumen, and on the other

hand richer in salts, which being absorbed, take the place of the others; and this is the intention of a true grape-cure, during which, partly fasting in the morning, partly at intervals during the day, from 1 to 6 and 8 pounds of grapes are taken. It is evident that by this means the retrogressive change of substance must be promoted, and that such a mode of treatment, carried on carefully and with due regard to the assimilating functions, must have the importance of a lixiviating remedy. Thus its use and its adaptibility for cases of corpulence and stasis of the abdomen are easily to be explained. All, however, that has been said of the whey-cure applies still more to the grape-cure. Dyspepsia and catarrh of the bowels are constantly the results of the treatment, and a case seldom occurs in which the object could not have been obtained by means of courses of mineral waters without any of these injurious symptoms.

Another class of conditions is better adapted to it, namely, bronchial catarrh and phthisis, because the treatment, as an antiphlogistic remedy, in the true sense of the word has proved successful in many of these cases; and this success is all the more conceivable, since we know that phthisis in many instances is produced by repeated catarrhal and inflammatory attacks. Yet it must not be forgotten that moderation must be observed in order not injuriously to affect the nutrition. A third indication, namely, *simple catarrh of the bladder*, has abundant empirical proof in its favour; and this may be also theoretically explained by the diuretic and anticatarrhal effects of the salts of the grape-juice.

The importance which is attributed to the small amount of albumen in grape-juice as a means of nutrition, is utterly unfounded. Whether whey and grape-juice contain any albumen at all, or not, is quite indifferent. The only matter of importance is, what amount of nitrogenous food is supplied by the other diet. In the choice of a resort for the grape-cure, the patient must not be misled by the superficial idea that the sweeter the grapes the more suitable they are for the cure. This only applies to not especially good grape years, when, of course, the

sweeter grapes are preferred, and the acid ones would not be selected. In a grape year especially favoured as to quality, the better, i.e. the sweeter, grapes are unsuited and injurious for medical use. In such a year as, for instance, in 1868, the less sweet grapes of the Rhine, the Palatinate, and even Grünberg, are better than the over-rich and moreover hard-skinned grapes of southern places, such as Meran and Bozen, as the latter often quickly produce dyspepsia, constipation, and the like.

The best known resorts for the grape-cure are *Meran* and *Bozen*, in the Tyrol; *Montreux* and *Bex*, near the Lake of Geneva; *Dürkheim*, *Gleisweiler*, and *Edenkoben* in the Haardt Mountains; *Grünberg*, in Silesia, and *Kreuznach*, on the Nahe. The railroad traffic, however, renders it possible to have fresh grapes everywhere.

CHAPTER X.

IRON-WATERS.

Historical
survey.

IN our historical introduction, page 3, we have already mentioned the exaggerated estimation of steel-springs in the past century and in the beginning of the present one, and we have called it with Hauck an error of the age. Practical and theoretic progress has in our own day greatly removed this error. The immense number of minutely differing preparations of iron in which earlier pharmacology took delight, scarcely possess now more than an historical value. Most chronic conditions of illness, in which recourse was formerly gladly had to the 'strengthening' use of iron, now employ other and more rational means and methods, more in accordance with the *indicatio morbi*; for instance, sea-bathing, with the increasing appreciation of which the use of iron-springs has more and more diminished; and of all the instances once considered suitable for its use, iron is at the present day almost exclusively reserved for those cases of poverty of blood which belong to the class of chlorosis or of anæmia caused by direct loss of juices.

Yet iron is not by any means on this account a less important remedy than it once was. By the perception and limitation of the conditions adapted for its use, its effect is more secured; and what it has lost as regards chronic diseases, it has gained in cases of acute anæmia, consequent on pneumonic and pleuritic exudations. This is one of the most beautiful advances in the science of our age, and which, obtained over old and strong prejudices, procured us considerable successes.

Carbonate
of oxide of
iron.

As regards *iron-waters*, it is, with few exceptions, the bicarbonate of the protoxide of iron which characterises a

number of mineral waters as *steel-springs*. Yet the chemical constitution of this iron-salt contains in no wise any excellence above all other preparations, like metallic iron, hydrate, acetate, and malate; again, the carbonate of protoxide of iron is transformed in the stomach into lactate of iron, and perhaps frequently also into chloride of iron, and in the intestines into lactate, and at last it reaches the blood in chemical combination with protein matter. Lactate of iron is the best adapted for rapid absorption.

The valuable properties of steel-waters are as follows. —1. They contain a combination of iron, the weak acid of which does not oppose the transformation into lactate. 2. They contain this combination in a very diluted solution, by which means this transformation is, *under certain circumstances*, promoted. 3. They contain free carbonic acid enough to stimulate the functions of the stomach and bowels. The advantages named under 2 and 3 may, however, under certain circumstances, become disadvantages; and the result depends on the practical skill in the selection of the chalybeate remedy. The immediate effect, and the digestion and absorption of mild preparations of iron, namely, of lactate iron, of iron combined with vegetable acid, of carbonate of iron, and metallic iron, are mainly dependent on three causes. (1.) On the *dose*. None but small doses are easily decomposed and absorbed; larger ones impede the secretion of the acid of the stomach and absorption, and this not merely relatively, but absolutely, so that, for instance, of a dose of two grains of a preparation of iron absolutely more iron is absorbed than of a dose of six grains. (2.) On the degree of *solution*; and (3.) on the individual state of the *stomach*. In the latter respect, however, no general rule can be given. Very frequently small and undissolved doses are more easily digested than voluminous solutions; and even in great atony of the stomach, the favourable effect of the carbonic acid is often paralysed by the inundation of the stomach with so large a quantity of water as is required for the introduction of a sufficient dose of iron. Hence the treatment must very frequently be one of experiment;

Conditions
of the effect
of iron.

and hence earlier physicians have often achieved as much and more with their pharmaceutical preparations of iron in cases of chlorosis, as recent ones with their predilection for steel-waters. In the same way, in cases of pneumonia, especially among children, pharmaceutical preparations are generally preferred to steel-waters, because the heating and stifling effect of the carbonic acid is distinctly contra-indicated by the state of the lungs and of the pulmonic circulation.

The necessary minuteness of the doses of iron was mentioned by me some years ago,¹ and has recently been strongly emphasised by Lebert; and it was one advantage of steel-springs compared with usual pharmaceutic treatment in an age that delighted in the erroneous use of large doses, that even large quantities of the mineral water only supplied the stomach with small doses of iron, though all the more passed from the unaffected stomach into the blood. In addition to this, however, we have to take into consideration all the influences which accompany a course of mineral waters generally speaking, especially as regards persons suited to a course of steel, and the final effect of which is in harmony with the intended effect of a course of iron, namely, change of climate, mountain-air, country and forest life, diet, increased use of water, psychical regimen generally, and frequently also the assistance of stimulating baths.

*Effect on
the blood.*

The effect of iron on the blood is universally known as regards its final result, but nothing is in any case accurately ascertained as to the chemical action. What function the iron possesses as a component part of the hematin, we know not; and the opinion that it is the vehicle of oxygen does not explain everything, even if it were universally accepted. That the composition of the hematin, however, is connected with a certain fixed amount of iron, and that its formation is dependent on the presence of iron; that the diminution of the blood also diminishes the relative quantity of the hematin, and that a supply of iron counteracts this diminution; these are facts which place the importance of iron in the for-

¹ *Bad Oeynhausen und die Grundzüge der Allgem. Bath.* 1865.

mation of blood beyond question, and which for the present must be sufficient, and are sufficient to give a theoretical form to practical maxims on the subject. It does not, however, follow from this, that it must always be the iron of apothecaries' shops and of mineral springs which has to be supplied to the body for increasing the formation of blood. This process requires, on the contrary, other organic and inorganic substances, which must exist in sufficient quantity and quality in order to form healthy blood with the ferruginous hematin; these substances are to be found in the food prepared by digestion, and in these, in meat especially, iron is likewise present. Moreover, the mere supply of these substances is not sufficient, but the vigour of the assimilating functions is also necessary, and in many cases is even exclusively so. It is therefore explicable why so many cases of poverty of blood are cured by remedies which, without supplying iron to the stomach, promote change of substance, nutrition, and digestion, and place the organism in a condition to assimilate the iron contained in food, and why frequently a meat-diet achieves the same as has been looked for from a course of iron, and often in vain. In fact, the numerous cases of that anæmia which accompanies every state of convalescence after acute or chronic illness, are but seldom subjected only to medicinal treatment, but are successfully consigned to nurture and diet. In the same way we may explain the numerous cases of genuine chlorosis, in which direct courses of iron have frequently proved unsuccessful, but which have been counteracted by indirect remedies, by common salt waters, by baths, by the cold water system, sea-air, sea-baths, travel, and the like; an alternative which in individual cases is usually only proved by the result as *ex juvantibus et non juvantibus*.

Real chlorosis of development proceeds probably from a direct loss of iron, which frequently, though not always, manifests itself at first in the increased amount of iron in the urine; and this is the form of anæmia in which the use of iron has proved most successful. Other forms of poverty of blood proceed more from *deficient general nutrition*, and exhibit less a lack of blood-cells than of

Stomach and assimilation: these are the cases in which a direct supply of iron is useless, and even injurious. In every case, therefore, the question must be raised as to whether the iron is to be supplied direct to the blood, or whether the organism is to be placed in a position to assimilate it as well as other constituents of the blood from the food taken; and not merely must the individual conditions in each case be taken into consideration, but frequently, as every practitioner finds, the trial must teach which of the two methods will produce the object desired.

*Effect on
the
stomach
and
bowels.*

The *direct and momentary effect* of iron on the stomach and bowels, as well as on the circulation and the production of heat, is dependent on so many individual conditions, that general rules must only be used with great caution. Whether, as is frequently asserted, the secretion of the acid of the stomach is diminished by iron, has been in no wise ascertained by experiments on animals. Nothing is certain but that the lactic acid of the gastric juice has a tendency to combine with iron; and its effect, therefore, on the digestion in the stomach depends on the quantitative proportion which prevails between the existing secretion of acid of the stomach and the dose of iron. The function of the stomach, therefore, is sometimes promoted and sometimes diminished, according as the formation of the gastric juice is abundant or slight, and according as the iron is given in greater or smaller doses, and according to the choice of the preparation; and in this respect the lactate of iron stands foremost in those cases in which the secretion of the acid of the stomach is in itself at a low ebb. With regard to iron-waters, the advantage, it is true, prevails that the carbonic acid contained in them produces an effect on the stomach by stimulating the secretions and promoting its action; yet it must not be forgotten that in many individuals the stimulus of this acid and the filling of the stomach with water are not borne, and that the digestion is thus directly affected.

The *effect also on the bowels* is dependent in many cases on individual conditions. Even as regards smaller doses of iron, not all is absorbed by the stomach and small intestine, but a quantity of lactate of iron or of reduced

iron passes further on into the intestines, and is carried off for the most part with the fæces as sulphuret of iron. In smaller quantities it diminishes the secretion of the intestinal membrane, and thus produces a constipating effect; but when taken in larger quantities, it is calculated, as a mechanical or chemical irritant, to produce serous secretion and diarrhœa. The quantitative amount, however, lying within these limits, is neither to be decided generally, nor can it be more than conjectured in individual cases, and even in these the treatment observed during the course is not uniform, but varies with the frequently undefinable phases of the daily health; and in this respect Schroff's experiments are of the utmost importance, as they prove that the passage of the iron into the urine takes place in positive and negative periods, the duration of which exhibit neither regularity nor any distinct dependence on special conditions. The one fact constantly appearing in these experiments was that, with the smallness of the dose, the passage into the urine, and thus the absorption of the iron, increased.

We have but few recent investigations as to the effect of iron on the *pulse and heat*. Iron-waters containing carbonic acid cannot be used for these experiments, because the direct effect of the carbonic acid frequently affects the pulse and the production of heat, in a manner which considerably obscures the possible share taken in this process by the iron absorbed. Recent experiments with other preparations show an acceleration and strengthening of the pulse, as well as a slight increase of the heat of the blood, phenomena which are certainly to be theoretically explained by the direct influence on the sanguification, and which have been symptomatically confirmed by cases of successfully treated chlorosis; whilst, on the other hand, earlier experiments, especially with sulphate of iron, have shown a considerable diminution of the frequency and strength of the pulse.

As regards the *entire dose* taken in a course of iron, none but small quantities are required in any case. The quantitative proportion of the diminution of the blood-corpuscles and of the hematin, in accurately estimated cases

Effect on
pulse and
heat.

Dose.

of chlorosis and anemia, and their increase at the conclusion of a successful course of iron, prove that the efficiency of iron to be restored in most cases does not exceed the quantity of from 10 to 20 grains; moreover, in all physiological and clinical experiences, no single fact shows that the amount of iron in the blood can be forced, or the organism compelled in any way to receive more iron and to form more hematin than is in keeping with its normal condition; and lastly, it is more than probable that, even in the healthy organism, the formation and constitution of hematin are not completed once for all, but, like all organic substances, are subject to the variations of organic life and to the phases of existence, growth, and decay. The theoretic conclusions arising from these facts are in thorough harmony with the experiences of clinical observations: 1, that only small doses accomplish the object, and that but little is absorbed from large doses; 2, that if the object be attained, the blood refuses to receive the excess of iron and to form an abnormal quantity of hematin; and 3, that, even in the course of the most favourable cures, there occur moments of different duration, in which the assimilation of the iron comes to a standstill; and at such times the physician should assist the treatment by interrupting the course or by improving some of the impaired functions. From physiological study and clinical experience, therefore, there result a few general principles for the treatment by courses of iron.

General
practical
principles.

1. In no course of treatment, as regards the estimation of the individual result, does the doubt obtrude itself as to whether the result is to be ascribed to the improved nutrition produced by the mountain-air, the exercise, and baths, or to the characteristic component part of the water taken, so constantly as in a course of steel-waters, most of which, in addition, stimulate the appetite and the digestion by means of the carbonic acid contained in them.

2. The good effects of the iron, both locally and generally, are dependent on small doses.

3. It is in many cases by no means indifferent whether the treatment is carried out with pharmaceutical preparations of iron or with a course of steel-waters. The condi-

tion of health is very frequently accompanied with a degree of atony of the stomach which either causes the carbonic acid to be retained from inability to reject it, or which forbids deluging of the stomach with water. Hence the use of non-voluminous preparations of iron more rarely gives rise to catarrh of the stomach and bowels than that of steel-springs.

4. The most important alternative as regards the indication and contra-indication of a course of iron is the *cause* of the existing poverty of blood. The more rapidly the anæmia has been produced, the more is a course of iron indicated; the longer and more complicated the cause, the more is it contra-indicated. The duration of the malady is an important matter. In recent cases, the use of iron very frequently attains the object required; in cases of long standing it is often not borne, and it often fails in producing the effect achieved in an indirect way by general treatment. The most certain hope is afforded by a course of iron in those cases in which, without any considerable complications in important blood-preparing organs, anæmia has been produced by direct loss of blood; for instance, by bleeding from wounds, from the nose, the rectum, and the uterus, or by sudden loss of the component parts of the blood, by profuse suppuration, diarrhoea, and by certain catarrhs, especially by excessive catarrh of the uterus and vagina; lastly, in cases of chlorosis of development, in which a direct loss of blood is occasioned by the excretion of iron with the urine, or by the excessive consumption of it for the disproportionate growth of muscular substance. The more, however, that anæmia is produced in indirect ways, the more that special derangements of the organs and nerves concur in causing it, or the more that these appear as attendant complications in the prolonged course of the disease, the slower and the more uncertain is the effect produced by the increased supply of iron. The most important instance of this contra-indication is afforded by complicated cases of hysteria of long standing, the convulsive attacks and morbid feelings of which, especially as regards the pneumogastric nerve, are very frequently aggravated by courses of iron, though

they are strikingly ameliorated by the indifferent baths of Schlangenbad and Wildbad, or by careful cold water treatment. An indication for the use of iron is, however, established by clinical experience in cases of considerable exudations in the lungs and pleura in consequence of pneumonia and pleuritis. In these cases it is almost a direct loss of blood that produces the anæmia; the sick person may sink from the anæmic condition, and iron frequently prevents the further progress of it. It is therefore explicable why at a time when, according to Broussais' theoretic system, almost all acute and many chronic diseases were erroneously treated by repeated withdrawal of blood, courses of iron were the order of the day. All sick persons thus treated become anæmic from direct loss of blood, and for this direct anæmia iron was indicated above all other remedies. This is still the case in Italy, where enlightened science struggles vainly to make its way, and to free itself from the almost national system of bleeding. At the time of constant bleeding direct anæmia was far more frequent, and hence the use of iron was more general than it is now.

EXAMINATION OF THE USUAL INDICATIONS.

From the statements made above it is not difficult to reduce the range of the ordinary conditions suited for the use of iron to a few clinical maxims.

Chlorosis.

1. *Chlorosis*

is the disease which most frequently presents a certain indication for the use of iron. Formerly this malady was treated with pharmaceutic and readily digestible iron remedies, attention being paid to the action of the bowels; and the result was not inferior to that obtained by the use of iron waters. With the poorer classes this is still the case, and recovery for the most part is more rapid. At the same time, we must not conceal a fact which perhaps essentially determines the more rapid success in chlorotic cases among the lower orders, namely, the greater physical exercise, labour, and exposure to the air, almost inseparable

from the existence of the poorer patients, in contrast to the more indolent mode of life pursued by chlorotic ladies.

In addition to this, among the higher classes, pure, uncomplicated chlorosis, such as we find among peasant girls, and which is rapidly to be removed, is far less frequent. Very often complications exist which render the malady obstinate, and impede the effect of the iron; for instance, psychological depression or excitement, scrofula, and fluor albus, which is but rarely observed in chlorotic peasant girls; spinal irritation and hysterical reflex excitability; impairment of the abdominal functions by the wearing of stays, or even change of position and flexion of the uterus, which has recently been more and more frequently observed in the early years of development. In many of these cases, iron-waters, owing to the carbonic acid and the large quantity of fluid required, are of less avail than pharmaceutical preparations of iron; in others, iron is not at all to be taken, and other rational remedies must be sought for. One instance may show this. A girl eighteen years of age had been suffering for two years, ever since the first and only occurrence of menstruation, from genuine chlorosis, extreme pallor of skin, violent palpitation of the heart, extremely frequent pulse, anæmic bruit, great torpidity of the intestinal canal, great mental and physical indolence, complete amenorrhœa, and considerable emaciation. For two years the sick girl had used pharmaceutic preparations of iron, and various iron-springs, without the slightest alleviation of any symptom. At last an eight weeks' course of a salt-water, namely, the Kissingen Ragoczy, so far effected an improvement that the constipation was diminished, that she became more cheerful, and that she gained in weight and general health. After a further four weeks of light meat and vegetable diet, combined with the moderate use of good Bavarian beer, all symptoms of illness were removed and the menstruation occurred regularly and properly. Upon her return home to the shores of the North Sea, a slight relapse at once occurred, and this was again speedily cured by removal to mountain-air.

The *advantages of steel-springs* consist, it is true, partly in the very same condition which in many cases form their disadvantages, namely, in the effect of the carbonic acid and water. Both these seem in many cases to impede the absorption of the iron, and therefore the true object of the treatment. Other advantages lie in attendant circumstances. Among these are the climatic change, travel, psychical stimulation, change of diet, and baths; and these are the circumstances which are to be taken into consideration in the frequently complicated cases of chlorosis among persons of the upper classes. Lastly, there are mineral waters containing iron, which call into play the sluggish functions of assimilation, owing to their amount of other salts, such as carbonate of soda, Glauber's salt, and common salt, and which thus increase the nutrition on the one side by removing this most important symptom, and on the other by promoting the absorption of the iron itself; we refer to the saline iron-waters of Franzensbad, Elster, and others. Generally speaking, in the selection of the various iron-springs, apart from climatic and other attendant circumstances, the following rules may be observed.

1. The more the torpidity of the intestinal canal predominates, the more are waters chosen which, from their amount of sulphates or common salt, promise to afford a salutary influence upon these complications.

2. The more the sluggishness of the bowels is increased under the use of steel-waters, the sooner must recourse be had to some other spring containing more salt or to some pharmaceutical preparation; or, for the time, the use of iron must be discontinued.

3. If dyspepsia and diarrhoea arise from the use of an iron water, especially of a pure acidulated chalybeate, this is a sign that the iron is not absorbed, but that it mechanically clogs the mucous membrane of the stomach and intestines; or also, that the water and the carbonic acid do not suit the individual condition of these organs. If a strict attention to the diet do not rapidly effect a change, either a pharmaceutical preparation must be chosen or the course of iron must be postponed.

4. If from the use of an iron water, there appear symptoms of congestion of the organs of the chest or head, these are scarcely to be ascribed to the iron, but far rather to the carbonic acid of the water; and accordingly either the carbonic acid must be removed or an ordinary preparation of iron must be taken.

5. Most steel-springs are cold; the stomachs, however, of most chlorotic girls resist the absorption of *larger quantities* of cold water, especially when containing carbonic acid. Hence the water is very frequently warmed by an addition of hot water or hot whey; the latter addition is especially popular—whether justly so, is questionable.

6. Neither with the successful use of pharmaceutical preparations of iron, nor with that of steel-springs, is the result at any time completed with the allowed duration of the treatment. Very frequently the rest is left to nature and regimen; in other cases, the treatment is repeated, after the organism from disusage has again become susceptible to the use of iron. In no case, however, may the course be continued until the symptom upon which the greatest importance is placed, namely, the amenorrhœa, has been completely overcome. The amenorrhœa is not the cause but the consequence, and indeed the salutary consequence, of chlorosis, for the state of the blood in that disease cannot bear the loss of regular menstruation. Very frequently all the other symptoms of chlorosis have disappeared or have become essentially improved, before menstruation appears in full vigour and regularity. The convalescence, differing as it does in different individuals, requires some time to render this important function bearable and possible; and it is a very erroneous measure to attack by forced courses of iron or by direct emmenagogues, a symptom which should be left to the compensating discretion of nature herself.

2. *Anæmia from other Causes.*

Anæmia.

H. E. Richter entitles his excellent popular pamphlet, 'Poverty of Blood and Chlorosis, the most universal

The *advantages of steel-springs* consist in some degree partly in the very same condition which in anemic malady and their disadvantages, namely, in the effluvia only those containing acid and water. Both these seem to impede the absorption of the iron, which does not affect the object of the treatment.

attendant circumstances, change, travel, psychical baths; and these taken into consideration, we will group the most cases of chlorosis according to their suitability. Lastly, and on this point the statement call for the anæmia and the more directly it proceeds from positive loss of blood and of the component parts of the blood, the more the use of iron is indicated; and that, on the other hand, this indication becomes all the more doubtful the more the anæmia is produced indirectly, and from deficient supplies of food and nutrition, and the more complicated and prolonged the case. For the sake of practice and brevity, it is best, therefore, to designate these three classes with distinct names, namely, *direct, indirect, and complicated anæmia*.

With the exception of chlorosis, the purest cases of *direct anæmia* are those which in otherwise healthy organisms and without essential complications, arise from sudden or violent bleedings and suppurations, as well as from large and rapid exudations, especially in pneumonia and pleuritis, and in the pneumonia of children. In all these cases the indication appears urgent, and it is not desirable to wait for the summer and the possibility of courses of waters. Recourse must be had almost exclusively to pharmaceutical preparations of iron; for instance, to lactate, acetate, or pomate of iron; and very rarely in such cases is a voluminous iron-water containing carbonic acid capable of being taken. It is only when this treatment and subsequent care do not fully accomplish the object, and a considerable degree of anæmia is left behind, that recourse may be had to its alternation with a course of steel-waters.

The *anæmia attending convalescence* is usually all the more direct, the more that direct loss of the juices of the

system has accompanied the originally acute or chronic malady; but it is all the more indirect, the less this is the case, and the longer the duration of the illness; lastly, it is all the more complicated, the more the important organs and functions still remain affected; and by these symptoms may be regulated the possible advantage arising from the use of iron. The two latter cases admit the use of iron but rarely; they require rather other strengthening methods, which have been discussed in former chapters in this book.¹

Anæmia in consequence of long-continued loss of juices, arising from suppuration of the bones, diarrhoea, catarrh, fluor albus and the like, is always indirect and complicated. It proceeds very rarely from pure poverty of blood-cells and of hematin, but from general poverty of blood, and is usually not suitable for direct iron-treatment. In addition to the treatment of the original disease, the chief matters required are nursing, pure air, and diet. The latter especially, when combined with remedies that promote digestion, is the principal matter; namely, milk, meat, and fatty diet. It is only in a later stage that a condition similar to chlorosis is developed, and this demands the use of iron and is able to bear it. Very frequently the use of iron is indicated in the anæmia which has arisen from bad confinements and from exhausting lactation; and these are also the cases in which courses of steel-waters are to be recommended with their attendant influences. In the latter case, however, attention must be paid to an important complication: in consequence of exhausting lactation, the anæmia is very frequently accompanied with a great degree of cardialgia and pyrosis, which are not always able to stand steel-waters, but which frequently require other remedies, especially narcotics, and above all, the empirical mixture used by Heim of carbon, quassia, and magnesia. Spinal irritation also very frequently appears in consequence of lactation, and it requires warm and cold forms of baths, whilst courses of waters, with their accompanying exhaust-

¹ See especially pages 132, 241, and 258.

ing morning walk, are apt to increase the pain in the back.

Lastly, there remains the unlimited range of cases of *anæmia proceeding from deficient nutrition*. Whether produced by a scanty supply of nourishment or by the defective functions of the organs of assimilation, this anæmia, which appears both indirect and complicated, results both from insufficient food and from all possible chronic diseases. The rule alone applies to these cases, namely, that the use of iron is very rarely indicated and is very rarely advantageous, and that under certain circumstances it is only advantageous when, in the course of the condition, *the temporary period for its use* is justly and wisely seized and measured. In many of these cases, periods occur in which the symptoms of true chlorosis, i.e. of predominating poverty of blood-cells, appear more prominently than any others. Under such circumstances, unless a complicated condition forbid it, iron and the use of iron-waters are permitted and prescribed, though only for a short time, that is, until these symptoms have been again essentially diminished.

The understanding and treatment of anæmia is the quintessence of medical practice in chronic diseases. The best work we can recommend on the subject, even for physicians, is the above-mentioned popular pamphlet by Richter.

Basedow's malady (Graves's disease, exophthalmic goitre), almost always combined with a great degree of anæmia, though the nature of the disease does not arise from this, has been in many cases ameliorated by the use of iron; and, so far as present experience reaches, the use of iron cannot be dispensed with.

Anomalies
of mens-
truation.

3. *Anomalies of Menstruation.*

We find in balneological works, and in the rules laid down by earlier pharmacologists, especially of Hufeland's time, a number of indications for the use of iron which are drawn from the various anomalies of menstruation. Experience teaches that iron is only useful in these cases

when the symptoms exhibit a perceptible degree of anæmia, and that it is injurious when the conditions are local, especially when they proceed from inflammations or new growths. Modern gynæcology, though still in its first stage, has yet so far advanced medical science to show that most of these cases may be traced to local processes; but the *vis inertia* of pharmacology and of Balneotherapy is reluctant to relinquish the field once occupied by them. Two instances may tend to illustrate this state of things.

Premature menstruation, so far as we have observed it in young girls of German birth, very rarely produces anæmia, but it is generally either accompanied with spinal irritation, or by robust maidenly development of body, which is entirely compatible with health, and the abnormal and diseased character of which only exists in the imagination of the relatives, though, perhaps, occasionally, as we have observed, manifesting itself in violent hemicrania. If circumstances enjoin anything to be done, recourse must be had to the opposite of the effect of iron, namely, to light diet and to a careful psychical regimen. The author has permanently cured a case of the kind, accompanied with violent hemicrania, by vegetable diet. And, nevertheless, we have seen numerous cases in which, even with this premature *plethora*, strong courses of iron have been prescribed, in a condition which in every respect forms the opposite to chlorosis. Even when, in consequence of premature puberty, spinal irritation occurs, the symptoms of actual chlorosis very rarely appear, and the condition is far more frequently to be treated with warm and cold baths, and with suitable regimen, than with iron.

Premature
Menstruation.

Another instance is afforded by profuse bleedings of the uterus. We have above stated that the anæmia produced by these bleedings is treated all the more successfully with iron, the more direct and uncomplicated it is in character. But, not satisfied with this, there is an idea, since it is the fashion to bring the uterus and iron into a strict traditional union, of removing even the bleedings themselves by means of iron. This is a sad theoretical error. Unbiased experience knows an astringent and styptic effect in iron only by the local contact of sulphate of iron and

Bleedings
of the
uterus.

chloride of iron with the mucous membranes, and with parts from which the epidermis is removed; and it uses these preparations only for local application to the bleeding uterus itself. All that the internal use of iron in metrorrhagia effects, is only to palliate and diminish the succeeding anæmia; and the cases are very rare, although their existence cannot be wholly denied, in which the anæmia itself keeps up the tendency to bleeding, and iron thus effects also an *indicatio morbi*.

4. *Atony of the Stomach and Intestinal Canal.*

Atony of
the sto-
mach and
intestines.

To this class belong many cases which afford a grateful scope for the use of iron; and iron-waters especially are justly popular, because in them a second *remedium morbi* is added to the iron, namely, carbonic acid.¹ Yet here also much is left to experimental empiricism, and frequently the use of pharmaceutical preparations is to be preferred, especially in the treatment of children. There is also that secondary chronic catarrh of the bowels, which proceeds from weakness of the skin, and which above all requires the *indicatio causalis* to be remedied.² Besides these cases, in which the effect of the local application of iron is called for, atony of the stomach and bowels is very frequently an accompanying symptom of chlorosis and anæmia, and in such cases the general influence of iron on the nutrition of the blood is added to its local influence.

5. *Neuroses.*

Neuroses.

Ever since the undue cultivation of empirical pharmacodynamics at the commencement of the present century, iron has been recommended for all possible cases of neurosis, and even a few preparations have been extolled as specific remedies for special forms of disease, as for instance, hydrated iron for neuralgia of the fifth nerve, hemicrania, &c. More recent medical practice has lost this faith in such a special effect from iron, and reserves the use of it only for those cases of neurosis which, as

¹ See p. 312.

² See pp. 111 and 335.

symptomatic of anæmia, place the case as one belonging to the *indicatio morbi*. Apart from this indication, we do not believe in any salutary effect from iron either in neuralgia or paralysis. Most of these cases are not caused by weakness, which requires strengthening, but they proceed from trophical and positive changes of tissues. The long discussion on the paralyses (p. 148 *et seq.*) shews how little is to be looked for from the use of iron. We must especially warn against the misuse of iron in cases of *spinal irritation* and *hysteria*; in these the general remedies of the thermal and cold-water systems are indicated (p. 110). If, nevertheless, the use of a steel spring is frequently found of advantage in various cases of neurosis, great attention must be paid to the attendant circumstances, such as travel, mountain air, and above all, the *baths*, which even when artificially heated, still frequently possess an effective amount of carbonic acid.

THE CHEMICAL CONSTITUTION OF IRON-SPRINGS.

Bicarbonate of protoxide of iron is contained in very many mineral waters; the requisite for its presence is free carbonic acid, and its amount varies between imperceptible traces and 6·2 grains in 16 ounces. This great amount is very rare; it appears in some unused springs, and in the steel-springs of Paráđ (4·8 and 5·3), the analysis of which is suspicious; and in the bath-spring of Muskau. The question with what amount of iron a mineral water has the right to be considered in a therapeutic respect as an iron-spring, can only be answered hypothetically, so long as no exact experiments are made on the spot, proving the amount of hematin obtained by the blood to increase in proportion with the use of the waters, and the excess of iron to be discharged with the urine. So long as experiments of this kind are wanting, we are thrown upon pure clinical experience as regards the general effect of springs, and we are met with the great difficulty of separating the effect of iron from the influences that accompany the course of treatment. The removal, for instance, of a sick person suffering from anæmia, from a level country to St. Moritz,

Chemical
constitution.

ing, to an elevation of 5400 feet above the sea, into pure fresh mountain-air and amidst the surroundings of magnificent scenery, is a remedy which in many cases is possibly more to be taken into consideration than the proportionally small amount of iron contained in the springs there—0·15 to 0·25. The question also surrounds itself and still awaits investigation, as to whether and how far the human organism varies, in its relation to iron and other remedies, with varying elevations above the level of the sea. There are springs which clinical custom claims as iron-waters, though containing only 0·1 grain of bicarbonate of iron; yet the most used and the most successful are those the amount of which lies between 0·3 and 0·9. The confirmed effect of these springs in cases of chlorosis first caused the salutary reduction of the large doses of iron formerly given. Supposing the average amount of these at 0·5 grains in 16 ounces, 0·5 to 1·5 grains of bicarbonate of iron, i.e. 0·14 to 0·42 grain of metallic iron, are on an average taken daily, in 16 to 48 ounces of mineral water; and if, with this calculation, we compare the fact that the deficiency of iron in cases of chlorosis amounts from 10 to 20 grains, it is evident that there is still an excess left from the larger daily dose, which is not absorbed. The effect of very weak iron-waters, however, in cases of chlorosis and anæmia, is explained by the well-founded supposition that, as soon as the improving effect of the iron has begun, the functions of assimilation are able to absorb iron from the food taken; that, therefore, the anæmia, which is to a certain extent diminished by artificial treatment, is finally and totally removed by nature herself through the improved, and in the true sense of the word "*steeled*," organism.

All the ordinary iron-springs contain more free carbonic acid than is required for the solution of the bicarbonate, and some of them far more than most sick persons suffering from anæmia can bear.

We know from Planta's and Fresenius' investigations, that a few cubic inches of carbonic gas are sufficient to keep the bicarbonate of iron in solution, and that the latter, from long standing in the air, is precipitated as oxide of

iron, not because free carbonic acid escapes, but because the oxygen of the air has an oxidizing effect upon it. These experiments, however, also teach that the oxidation takes place very slowly, and that an acidulated chalybeate may be left standing for a long time in an open vessel, presupposing that it is not shaken and thus the protecting gaseous layer removed. The same may be said with regard to the heating, which, even when amounting to 25° Cent. (87° Fahr.), reduces the iron but little.

The constitution of the water, as regards other component parts, may be of essential importance; but we are without any helpful investigations on the matter. Generally speaking, it may be assumed that the more a water has an aperient effect, the less may the absorption and effect of iron be calculated upon. Nevertheless, even in this respect we lack on the one side accurate experiences; and on the other the possibility of an effect from iron may be afforded even by salt springs such as Kissingen and Homburg; and such complicated waters as Franzensbad and Elster, with their amount of chloride of sodium, Glauber's salt, carbonate of soda, and iron, are very often used successfully in cases of anæmia.

We have already mentioned (p. 455) the advantage and eventual injury caused by carbonic acid in courses of iron for the case of anæmia. This gas only possesses any importance in itself, in so far as it acts beneficially or injuriously on the stomach and on the circulation.¹ The assertion that it facilitates the absorption of the iron itself is a mere fable: the atmospheric air which finds its way into the stomach with the waters, speedily, in combination with the lactic acid of the stomach, transforms the bicarbonate into lactate of oxide of iron, and the carbonic acid is only intended after exercising a passing effect to be removed again by eructation. It is not the solution of the iron in the gastric juice which is promoted by carbonic acid, but only the holding of the bicarbonate of iron in solution in the mineral water.

¹ See p. 310, *et seq.*

tain, besides, other salts in moderate quantities, especially Glauber's salt, carbonate of lime, carbonate of magnesia, also sulphate of magnesia, sulphate of lime, and a few also chloride of sodium. The above-mentioned alkaline saline waters belong to this class, namely, Marienbad, Franzensbad, Elster, and Tarasp.

	Iron.	Fixed component parts.
Radna	0.9	52
Driburg	0.78	40
Arapatak	1.60—2.35	25—27
Bartfeld	0.3 —0.6	17—42
Bocklet	0.6	28
Rippoldsau	0.4 —0.9	27
Pymont	0.57	25
Antogast	0.23	20
Godesberg	0.2	23
Petersthal	0.35	23
Freiersbach	0.3 —0.7	10—24
Reinerz	0.09—0.28	13
Griesbach	0.6	14
Hofgeismar	0.2 —0.4	21
Cudowa	0.15—0.2	15
St. Moritz	0.18—0.25	11—13
Imnau	0.5	8
[Orezza about	0.85	8]

6. *Pure iron-springs* (the fixed component parts of which only amount to a few grains).—*Brückenaue*, with 0.09 carbonate of oxide of iron; *Schandau*, 0.11; *Liebwärda*, 0.17; *Flinsberg*, 0.17; *Freienwalde*, 0.17; to 0.26; *Niederlangenaue*, 0.28; *Sternberg*, 0.24; *Rosenheim*, 0.32; *Gonten*, 0.33; *Königswarth*, 0.4 to 0.65; *Alexisbad*, 0.4; *Lobenstein*, 0.43; *Liebenstein*, 0.59; *Spa*, 0.37; *Schwalbach*, 0.44 to 0.64; *Altwasser*, 0.37 to 0.4; *Vichnye*, 0.95; *Muskau*, with 1.3 (!) carbonate of protoxide of iron and 1.5 sulphate of protoxide of iron; [*Tunbridge Wells*, about 0.11, and *Harrogate* (Tewitt) about 0.13].

The *temperature* of the iron-springs varies between 4° and 17.5° Cent. This difference is so far inconsiderable, as an addition of warm water has only a very slight influence in precipitating the iron. Far more important are the climatic circumstances, especially the *height of the situation*.¹ In this respect the best known iron springs stand in the following order:—[*Santa*

Height of
situation.

¹ See p. 47 *et seq.*

Catarina, 5,600 feet]; *St. Moritz*, 5,464; *Rippoldsau*, 1,886; *Reinerz*, 1,668; *Antogast*, 1,619; *Flinsberg*, 1,542; *Griesbach*, 1,500; *Lobenstein*, 1,500; *Eleter*, 1,465; *Imnau*, 1,430; *Alexisbad*, 1,450; [*Recoaro*, 1,400]; *Rosenheim*, 1,350; *Franzensbad*, 1,293; *Freiersbach*, 1,280; *Altwasser*, 1,255; *Cudowa*, 1,235; *Liebwerta*, 1,225; *Petersthal*, 1,190; *Niederlangenau*, 1,137; *Liebenstein* and *Spa*, 1,000; *Brückenau*, 915; *Schwalbach*, 900; *Driburg*, 633; *Bocklet*, 620; *Füred*, 460; [*Harrogate*, 420;] *Pyrmont*, 404; *Hofgeismar*, 328; and *Muskau*, 300; [*Tunbridge Wells*, about 300].

LIST OF THE BEST KNOWN IRON-SPRINGS.

Arapatak.

Arapatak, or *Elöpatak*, in Transylvania, only recently become a small spa, possesses two springs for drinking, requiring only small doses. A daily dose of eight ounces would be sufficient to supply an amount of from 0·8 to 1·2 grains of carbonate of protoxide of iron. The springs contain:

	I.	II.
Bicarbonate of protoxide of iron . .	1·16	2·35
lime	9·03	10·62
magnesia	5·99	4·46
soda	9·86	7·08
Carbonic acid	33 cub. in.	24 cub. in.
Temperature	8·8° C.	8·8° C.

Alexisbad.

Alexisbad, in the Selke valley of the Harz Mountains, 1,350 feet above the sea, agreeably situated, is a small bathing-resort possessing good arrangements, living at a reasonable cost, and fresh forest-air. It is a short hour's drive from Ballinstädt, and several hours' from the railway stations of Quedlingburg and Aschersleben. The Selkebrunnen is used for baths, and the Alexisbrunnen for drinking.

We have already (at page 304) expressed our opinion of the baths of the Selkebrunnen and the supposed astringent effect of the iron. They are indifferent baths, the effect of which is essentially assisted by the strengthening nature of the climate. On the other hand, the Alexis-

brunnen is a pure acidulated chalybeate of about the same constitution as the Pouhon spring at Spa. In sixteen ounces there are 3.44 grains of fixed component parts and among them 0.35 grains of bicarbonate of iron, and, moreover, ten cubic inches of free carbonic acid. The amount of carbonic acid is small in comparison with many other iron springs, but more than sufficient. (Drs. Rahn and Schauer.)

Altwasser, in Silesia, between Salzbrunn and Charlottenbrunn, 1,255 feet high, is situated in a pleasant and tolerably mild valley. The springs are pure iron-springs, and contain between 2.5 and 8 grains of fixed component parts; among them 0.3 to 0.73 of bicarbonate of iron, and, moreover, 4 to 27 cubic inches of free carbonic acid. Arrangements good, life cheap, and countrified. (Dr. Pohl.)

Antogast and the Kniebis Baths.—The *Kniebis* baths lie on the Badish Black Forest, at elevations of between 1,200 and 1,900 feet, and in situations affording an even and mild climate. They are *Rippoldsau* in the *Kinzigthal*, *Petersthal*, *Griesbach*, *Freiersbach*, and *Antogast* in the *Renchthal*. These places, which, on account of their iron-springs, are much frequented by persons in the adjacent country and in Alsace, have latterly become justly popular as climatic summer resorts in the same manner as *Badenweiler*. They possess beautiful scenery; they are easily reached from the stations on the Baden railway; they combine the fresh and soft air of the woods, without any violent transitions of temperature, with considerable elevation, and quiet bath-life; and they have, moreover, a choice of iron-springs which are adapted, like other very popular ones, for cases of anæmia—in fact, all circumstances combine to recommend these beautiful and woody mountain-resorts.

Antogast, in a deep ravine, 1,610 feet above the sea, the quietest and least frequented of the *Kniebis* baths, possesses a weak iron-spring (0.23 bicarbonate of iron). It is in other points similar to the *Petersthal* springs. (Dr. Bauer.)

Petersthal, 1,333 feet.

Kniebis
baths,
Antogast.

Petersthal.

	I.	II.	• III.
Bicarbonate of protoxide of iron .	0.338	0.346	0.354
" lime . . .	10.577	11.580	11.713
" magnesia . . .	2.9	4.4	3.5
Sulphate of soda . . .	5.1	6.5	6.0
Carbonic acid . . .	33 cub. in.	33 cub. in.	34 cub. in.
Temperature . . .	9° C. (48.2° F.)	9° C.	10° C. (59° F.)

Griesbach.

Griesbach, 1,614 feet.

Bicarbonate of protoxide of iron . . .	0.6
" lime . . .	12.2
" magnesia . . .	0.7
Sulphate of lime . . .	2.2
" soda . . .	6.0
Free carbonic acid . . .	18 cub. in.
Temperature . . .	10° C. (50° Fahr.)

(Dr. Haberer.)

Freiers-
bach.*Freiersbach*, 1,280 feet.

	I.	II.	III.
Bicarbonate of protoxide of iron . .	0.29	0.30	0.77
" lime . . .	6.55	10.48	4.29
" magnesia . . .	3.63	4.41	1.58
" soda . . .	1.38	1.58	0.76
Sulphate of soda . . .	0.34	5.81	2.15
Free carbonic acid . . .	18 cub. in.	15 cub. in.	14 cub. in.

The springs of Freiersbach are, accordingly, tolerably pure, No. 3 especially.

Rippold-
sau.

Rippoldsau, 1,886 feet, an old-established spa, with simple forest-life, but with excellent accommodation, promenades, and climate.

	I.	II.	III.
Bicarbonate of protoxide of iron .	0.39	0.45	0.94
" lime . . .	12.93	14.95	11.16
" magnesia . . .	0.54	2.88	0.80
Sulphate of soda . . .	0.31	6.76	8.13
Free carbonic acid . . .	15 cub. in.	16 cub. in.	15 cub. in.

(Dr. Feyerlin.)

Bartfeld.

Bartfeld, in Northern Hungary, on the southern declivity of the Carpathians, with springs containing 16 grains of carbonate of soda, 5 grains of chloride of

sodium, 0·67 grains bicarbonate of iron, and much carbonic acid.

Bocklet, 620 feet, two hours from Kissingen, in the valley of the Franconian Saale; climate mild. The spring is rich in carbonic acid, and contains 28 grains of saline ingredients. Bocklet.

Bicarbonate of protoxide of iron . . .	0·67
„ lime . . .	6·54
„ magnesia . . .	3·60
Chloride of magnesium . . .	4·43
Chloride of sodium . . .	6·55
Sulphate of soda . . .	2·54
„ magnesia . . .	3·23
Carbonic acid . . .	39 cub. in.

[*Bocklet* deserves to be recommended in cases of anæmia, where a retired life is desirable. The accommodation and food are tolerably good, and by no means extravagant in price. (Dr. G. Diruf.)]

Brückenaue, 915 feet above the sea, on the western declivity of the Rhön Mountain, not far from Kissingen, in a mild and pleasant situation. The spring is a pure but weak acidulated chalybeate. In 3·4 grains of fixed component parts there are only 0·09 grain of bicarbonate of iron, though 38 cubic inches of carbonic acid. It is really questionable whether a water of this kind can be called an iron-spring; at any rate it is too weak for serious courses of iron, in which from 10 to 20 grains of iron have to be assimilated within 4 or 6 weeks. Brückenaue.

[This again is a very quiet place, with simple but good arrangements under the supervision of the Bavarian Government. (Dr. Imhof.)]

Cudowa, in Silesia, close by the Bohemian frontier, 1,235 feet above sea-level on a high table-land, is a few hours distant from the railway stations of Frankenstein and Josephstadt. The climate, in spite of the position on the elevated plateau, is tolerably mild. The springs are weak acidulated alkaline chalybeates. Cudowa.

	I.	II.	III.
Bicarbonate of protoxide of iron .	0.19	0.20	0.15
" soda	9.40	9.50	7.30
Sulphate of soda	5.42	5.45	4.18
Carbonate of lime	3.76	3.85	2.95
Carbonic acid	33 cub. in.	—	—

(Drs. Jacob and Scholtz.)

Driburg.

Driburg, in Westphalia, three hours from Paderborn, two from the railway station of Buke, is situated 633 feet above the sea, in a pleasant valley with a fresh climate. The arrangements are very good, especially as regards baths, and there is a strong iron-spring.

Bicarbonate of protoxide of iron	0.78
" lime	14.89
Sulphate of soda	7.95
" magnesia	4.78
" lime	10.15
Carbonic acid	28 cub. in.
Temperature	10° C. (50° F.)

(Drs. Brück, Riefenstahl, Venn.)

Flinsberg.

Flinsberg, in Silesia, close by the Bohemian frontier, two hours from the station of Greifenberg, is beautifully situated at an elevation of 1,550 feet above the sea. The climate is very fresh, and the life simple and cheap. It has very pure but weak steel-springs, containing from 2 to 6 grains of fixed component parts; among them 0.17 to 0.25 of bicarbonate of iron; and 27 cubic inches of carbonic acid. (Dr. Adam.)

Freien-
walde.

Freienwalde, on the Oder, is an important resort from Berlin, and teems with anæmic cases. The springs are moderately weak iron-waters, very pure, with little carbonic acid. (Drs. Algidi and Tchepke.)

Godes-
berg.

Godesberg, near Bonn, a favourite Rhenish summer-resort, with an excellent cold-water establishment and a newly discovered earthy-saline and gaseous iron-spring.

Carbonate of soda	7.4
" magnesia	3.2
" lime	2
" protoxide of iron	0.2
" chloride of sodium	7.3

(Professor Dr. Finklenburg and Dr. Gerber.)

[*Harrogate* contains iron in several of its springs in considerable quantity, but it has an almost pure iron-spring in the *Tewit*, the action of which is heightened by the tonic climate of Harrogate. The *Tewitt* contains about 1·1 grains of solids, with 0·135 of carbonate of iron.] Harrogate.

Hofgeismar, in the former electorate of Hesse, on the railway from Cassel to Carlshafen, is situated 328 feet above the sea, in a pleasant broad valley. The living is very cheap and simple, and there are moderately strong iron springs. Hofgeismar.

Imnau, in Hohenzollern, 1,430 feet above the sea, situated in a pleasant valley, a small and simple spa. Imnau. The springs are pure, with 0·08 to 0·64 bicarbonate of iron, and much carbonic acid.

[Not far from the railway station Eyach. (Drs. Rehmann and Wern.)]

Königswarth, between Franzensbad and Marienbad; 2,000 feet high, in a sheltered situation, with a fresh climate specially adapted for anæmic cases, and several very pure steel-springs, the quantity of bicarbonate of iron in which amounts to 0·40, 0·57, and 0·65, besides about 30 cubic inches of carbonic acid, and from 5 to 6 grains of salts. The springs, therefore, are similar in importance to those of Schwalbach and Spa. Königswarth.

[*Königswarth* lies on the southern slope of a mountain range, open to the south and south-west, sheltered from the north, north-east, and north-west winds. As well by this circumstance as by the purity of the air, and the elevation, the place is well adapted for climatic cures in anæmia, chronic pneumonic affections, and tendency to consumption, as recommended by Dr. Küchenmeister, of Dresden. (Dr. Kohn.)]

Krynica, in Galicia, 4 hours' drive from Neu-Sandec, 1,790 feet above the sea, possesses a gaseous chalybeate. Krynica.

Liebenstein, on the south-west declivity of the Thuringian forest, 1,000 feet above the sea, is much frequented by North Germans as a summer-resort on account of its fresh forest and mountain air. The living is simple and inexpensive, though entertaining. There are a cold-water establishment (p. 120), a goat's-whey establishment, besides baths of the warmed acidulated spring, and of mother-lye, and a strong and tolerably pure steel-spring. Liebenstein.

St. Moritz, in the Upper Engadin, a long day's journey by carriage from the nearest station, Coire, 5,400 feet above the sea, is situated in an alpine valley, rich in vegetation. As a climatic resort of high situation, it has become justly popular; it possesses a very salutary and refreshing climate, even for many individuals requiring delicate management. There is no lack of dew and hoar-frost, but mists are rare. The days in mid-summer are like ordinary May-days in Central Germany, and colds are rarely taken, presupposing that warm clothing is worn morning and evening.

In a spa so highly situated, a knowledge of the temperature of the air is often necessary as a guide for sick persons. The average temperatures observed are :—

	7 o'clock A.M.	1 o'clock noon.	9 o'clock P.M.
	Fahr.	Fahr.	Fahr.
June . . .	5° C. (41°)	14° C. (57·2°)	9° C. (48·2°)
July . . .	10° C. (50°)	16° C. (60·8°)	9·5° C. (49·1°)
August . . .	8° C. (46·4)	14° C. (57·2°)	8·3° C. (47°)
September . . .	5·8° C. (42·4°)	12° C. (53·6°)	6·2° C. (43·2°)

The springs are moderately strong in their amount of iron, very strong in carbonic acid, and for the rest tolerably pure; the baths contain, from the excessive amount of gas, carbonic acid enough to give them the effect of gaseous baths. *St. Moritz* combines with its medicinal resources, very pure air, very high situation, moderately strong steel-springs and gaseous baths; it affords, moreover, the comforts of life in the midst of grand alpine scenery.

	I.	II.
Bicarbonate of protoxide of iron . . .	0·18	0·25
" magnesia	0·96	1·21
" lime	5·57	6·84
" soda	1·46	1·59
Sulphate of soda	2·09	2·67
Carbonic acid	31 cub. in.	57 cub. in.
Temperature	5·8° C.	4° C.
	(41·6° F.)	(39·2° F.)

[Drs. Berry and Brügger are the resident Swiss physi-

cians. Drs. Drummond and Menzies are likewise allowed to practise at St. Moritz during the spa season, which lasts from the middle of June to the middle of September, as far as the bathing is concerned, though the climate possesses great advantages also at other times for some constitutions, especially during the autumn and winter.—See the chapter on the climatic treatment of consumption.]

Nieder-
langenau.

Niederlangenau, in the county of Glatz, 1,137 feet above the sea, in a beautiful and sheltered valley, affords, from its position and its springs, one of the best spas for courses of iron, especially for sick persons who require simple and quiet spa-life. The spring is very pure, containing only 6 grains of fixed component parts; among them $2\frac{1}{2}$ grains of carbonate of lime and 0.28 of bicarbonate of iron, 35 cubic inches of carbonic acid: temperature 9° Cent. (48.2° Fahr.).

[*Orezza*, in Corsica, about 20 English miles from Bastia, is one of the strongest acidulated iron-springs, with about 0.85 of bicarbonate of iron in 16 ounces, about 5 grains of carbonate of lime, small proportions of some other substances, and much carbonic acid, which is favourable to the employment of the water at a distance from the spring.]

Pymont.

Pymont.—Respecting the sool-baths and sool-waters there, see pages 232 and 404. The steel-spring contains:

Bicarbonate of protoxide of iron	. . .	0.57
" lime	. . .	10.47
Sulphate of magnesia	. . .	3.88
" lime	. . .	9.05
Free carbonic acid	. . .	29 cub. in.
Temperature	. . .	13.2° C.
		(55.8° F.)

It is reckoned among the stronger compound iron springs. The situation is healthy, agreeable, and mild, in a deep valley 400 feet above the level of the sea. The arrangements, dwelling-houses, and mode of life are in keeping with a large and old-established spa.

There was a time when no one spoke of cases adapted to the use of iron, but of cases adapted for the Pymont for Pymont was the most frequented of all spas,

and the rendezvous of the fashionable world. This time lasted for centuries, but it has passed away. The use of iron-water has become more limited, and either highly situated places or others more within reach have risen into fashion. (Drs. Gieseken, Lyncker, Mencke, Seebohm, and Valentiner.)

[*Recoaro*, about 1,400 feet above sea-level, in North Italy, in a charming valley four hours' drive from the station Vicenza, is a place much visited by the Italians. It possesses several springs with a medium amount of iron, some lime-salts, and a sufficient quantity of carbonic acid.]

Reinerz, in the county of Glatz, a county rich in springs, 1,720 feet above the sea, with a fresh climate corresponding with its high situation, has a very good whey-establishment and two springs for drinking, rich in carbonic acid and tolerably pure. Only one of these, however, contains an amount of iron which can be taken into consideration in iron treatment. Reinerz.

	Cold Spring.	Lukewarm Spring.
Bicarbonate of protoxide of iron	0.09	0.29
Other component parts	7	13
Carbonic acid	40 cub. in.	35 cub. in.
Temperature	8.7° C. (47.7° F.)	17° C. (62.6° F.)

Reinerz has increased in importance within the last few years, since a high situation for those suffering from the lungs is no longer feared. These visitors find there also a very carefully conducted whey establishment and moor-baths. (Drs. Berg, Drescher, and Joseph.)

*Rosenheim*¹ also possesses an iron-spring, which is very pure, containing sufficient carbonic acid and 0.32 of Rosenheim. ulmate of iron.

[*Santa Catarina*, in the Orteler district, in Upper Italy, three English miles from Bormio, about 5,600 feet above the sea-level, possesses springs very similar to those of St. Moritz. The accommodation is simple, but clean. The scenery is very grand; the climate analogous to that of the Upper Engadin; possibly, therefore, the place

¹ See p. 226.

may some day become as fashionable as St. Moritz is at present. [Dr. Casella.]

Scharlau, in Saxony Switzerland, beautifully situated, with fresh summer-climate, a favourite resort in summer. The spring is a very pure, but also a very weak iron-water, with 0.11 grains of bicarbonate of iron.

Schwalbach, next to Spa, the most frequented and favourite iron-spring in Germany, combines in itself every favourable circumstance for its popularity: moderately high situation, fresh air, sheltered climate, excellent arrangements, efficient and, at the same time, careful physicians, and strong iron-springs, which, moreover, are tolerably pure. The clean and long town lies in a valley of the Taunus, or partly on a sloping plateau, from which numerous valleys emanate. It is 900 feet above the sea, and it may be reached in a few hours from Wiesbaden and Biebrich, and from the Nassau railway station. It is one hour from Schlangenbad. The society is mixed, but respectable; a great part of the visitors consist of anæmic ladies, especially from England.

	Stahlbrunn.	Weinbr.	Paulinenbr.
Bicarbonate of protoxide of iron	0.64	0.44	0.51
" magnesium	0.14	0.07	0.09
" magnesia	1.63	4.46	1.23
" lime	1.67	4.39	1.65
" soda	0.15	1.88	0.13
Carbonic acid	50 cub. in.	45 cub. in.	40 cub. in.
Temperature	8.8°—10° Cent. (47.8° Fahr.—50° Fahr.)		

(Drs. Genth, senior and junior; Fritze, Frickhofer, and other physicians.)

Spa, in Belgium, situated in a beautiful and mild valley of the Ardennes, 1,000 feet above the sea, is a luxurious bathing resort possessing steel springs, which, like the Schwalbach springs, are very pure. The best known is the *Pouhon*.

Bicarbonate of protoxide of iron	0.37
Other component parts	3.08
Carbonic acid	8 cub. in.
Temperature	11.2° C. (52.1° F.)

[Other much-used springs at Spa are the *Groesbeck*, the *Sauvénère*, and the *Géronstère*. The new bathing arrangements are very good. (Drs. Cutler, Jules Lezaak, and other physicians.)]

Sternberg, three hours from Prague, situated on a Sternberg.
table-land, with a fresh, but not rude, climate, possesses very pure, moderately strong iron-spring, with 4·70 grains of fixed component parts; among them 0·24 grains of bicarbonate of iron, and 8 cubic inches of carbonic acid.

[*Tunbridge Wells*, in Kent, about 300 feet above sea-level, possesses a weak but tolerably pure chalybeate spring, with only a small quantity of carbonic acid. The bathing arrangements are imperfect, but the climate is healthy and invigorating, and well adapted to assist the moderate use of the water; and the latter may be rendered more useful to some constitutions by the addition of a simple acidulated water, like *Selters* or *Apollinaris*.]

Wiesau, 1,642 feet above the sea, station on the East Wiesau.
Bavarian railway, still little frequented on account of its bad arrangements, possesses a very pure iron-spring of the strength of the *Schwalbach Stahlbrunnen*, with a tolerably large amount of carbonic acid. (Dr. Saamer.)

CHAPTER VI.

THE ANAL. REPORTS ARE IT SELVES.

Important and indispensable as it is for the geologist and chemist to accurately determine those component parts of mineral waters which appear in them only in very small quantities, the circumstance is unrefreshing and tedious with which the advocates of Balneology endeavor to make the most of the existence of these substances, which in truth have only the importance of *minimal quantities*, i.e. of quantities the effect of which is *imperceptible*. The analyses in the last chapter prove that each component part, according to the effect of which certain mineral springs are classed, estimated and calculated upon, exists in other springs in minimal, i.e. in ineffectual quantities. The most important substances, such as chloride of sodium, sulphates, carbonate of soda, iron, carbonate of lime and others, only play the part of minimals in a number of springs; and even the amount of bromine and iodine, frequently so strongly emphasised, falls in most springs into the list of these microscopic pharmacodynamics. Phosphates, alumina, and silica are likewise found in the waters only in such small proportions, compared with their daily reception through the vehicle of food, that they lose all importance. Silica comes at best only into consideration from its chemical relation to sulphur-waters, inasmuch as its presence possibly assists in the formation of sulphuretted hydrogen.

Recently, especial importance has been placed on the existence of *arsenic* and *lithia*, but, in spite of the loud assertions of balneological literature, there is scarcely a medical practitioner who would really calculate upon these intangible agents. And justly so, for, since the

invention of the spectral analysis, the springs containing arsenic and lithia more and more lose their distinction, as both substances are more constantly discovered in springs, and not merely in these, but even in many articles of food; and the question is no longer asked as to what springs contain them, but as to what springs do not contain them.

In the second place, however, the exact amount of these substances in the springs is not to be accurately determined.

In the third place, they appear, even according to this determination, in such slight quantitative proportions, that they could only be taken into consideration in those courses of treatment in which immense daily doses of the mineral waters are used.

And, lastly, lithia is a remedy the effect of which has only recently been discovered. It is here and there recommended in cases of gout and stone, 'for the solution of the stone,' and in chronic exanthemata, in both cases in tenfold and fortyfold larger doses than mineral waters afford, and in both cases, especially in the former, with a less than doubtful effect.

There is only one spring, the Murquelle at Baden-Baden, which is distinguished for a considerable quantity of lithia, viz., 0.4 of the chloride of lithium in 16 ounces; and here, at any rate, the opportunity would be afforded of observing the effect of lithia, presupposing that this were already ascertained, and even then only to a small extent, as the pharmacological dose amounts to twenty grains in the day. Next to the Murquelle is the Fettquelle, in the same place, with 0.23 grains of chloride of lithium, and a spring in Elster, with 0.76 of carbonate of lithia. If even these are minimal doses, the amount of lithia contained in other springs may be taken out of all therapeutic calculation, varying as it does, from incalculable traces, to an amount of 0.1 grain of the chloride or of the carbonate of lithia.

The case is in no wise different with *arsenic*, the discovery of which in mineral waters for the last thirty years has been an interesting problem for chemists. We

may mention a few instances among the better known mineral springs. Reinerz, Pyrmont, Petersthal, Nauheim, and Sternberg contain traces: Driberg, 0.0003 grains of arsenious acid, i.e. not more than a trace, though expressed in numbers: Gubwa, 0.001; Baden, 0.003, and a spring at Nauheim, 0.004 arseniate of iron: Wiesbaden, 0.001 arseniate of lime: Mondorf, 0.002; Kissingen, 0.009; Plombières, 0.0008; Oeynhausen, 0.009 arsenious acid, and Vichy, 0.01 arseniate of soda.

If we compare with this amount, which is for the most part, moreover, determined by the *sediment* of the springs, the average dose of arsenious acid taken in pharmaceutical preparations, namely, $\frac{1}{12}$ to $\frac{1}{17}$ grain per dose, and as much as $\frac{1}{2}$ and even $\frac{1}{4}$ of a grain per diem, we find that from 4 to 5 pints of those waters would have to be daily taken, i.e. from 80 to 160 ounces, in order to calculate upon any effect. And, moreover, in opposition to all practical maxims, arsenic would thus be given in the most complicated vehicles.

[If Lefort's analyses of the springs of Bourboule be corroborated, we may grant a somewhat greater importance to the arsenic as a constituent of mineral springs; for, according to these analyses, two of the springs of Bourboule contain about $\frac{1}{16}$ grain of arseniate of soda in 16 ounces of water, combined with about 50 grains of other solid constituents, especially common salt and bicarbonate of soda.]

SUPPLEMENT.

NOSOLOGICAL AND CLINICAL SUMMARY OF THE CONTENTS
OF THE FIRST THREE BOOKS.

ALL the various balneotherapeutic indications derived from the nosological nature of the case, are subject in each individual case to the *general indication*, i.e. to the decision of the question as to how great demands are to be made on the given organism of the individual himself, for his own co-operation in the organic reform which is the expected result of the treatment; and whether and to what extent the subject of the case of illness belongs to individuals *requiring delicate treatment*, or to those *capable of co-operation*. Whilst the *indicationes morbi* are mechanically taken, so to say, from memory, and require not much mental consideration, the *indicatio individui* falls within the range of the true art of healing, and presupposes an intelligent acquaintance with the diseased aspect of human life and an intimate knowledge of the person in question; and this is the reason why hasty consultations with physicians, who, though authorities in their branch of the profession, are strangers to the sick person, often prove unavailing, unless the family physician cast his individual knowledge of the case and of the diseased organism into the scale.

The
alterna-
tive of
the gene-
ral indica-
tion.

The therapeutic influences which characterise both sides of this general alternative may be summed up in a few words.

For *individuals requiring delicate treatment*, heat, summer, the average forms of the thermal system, the mildest forms of the cold-water system (with the exception of hysteria, which generally both requires and bears energetic treatment), in short, a gentle or moderate amount of all systems, elevated situation of the health-

resort, and a careful and wise choice the general regiminal influences. For *individuals capable of affording co-operation*, a cooler season of the year, spring and autumn, even winter, a stronger amount of all medicinal influences, very cold and very warm forms of baths, all that provokes resistance and reaction, a lower situation, sea-air and sea-baths.

Impeded
convalescence.

Impeded Convalescence, and the kindred conditions of general atrophy and of deficient regenerative power, which appear in many chronic illnesses, require great caution. The severer the condition and the greater the number, or the more important the kind of prostrated functions, the less may such means and methods, generally speaking, be used, as make greater demands on the sick person's own powers, and on his resistance. The convalescent belongs in general to individuals requiring delicate treatment, and the skill of the physician with respect to him consists in observing a careful medium between sparing and stimulating his powers. The directly exciting remedies ought not to exceed a certain moderate limit. The method most generally applicable and prescribed is the *milder thermal method*; lukewarm and moderately warm baths at intervals adapted to the individual, especially indifferent thermal and sool-baths at places of high situation, gaseous thermal sool-baths for the stimulation of the change of substance, and for the greater invigoration of the skin, also sea-baths and sea-air in special complicated cases and in later and easier stages of convalescence. In the most difficult cases, in which the diseased organism cannot bear either the unavoidable excitements of even the mildest method of bath-treatment, and cannot even afford resistance to the integrant stimuli of life, what cannot be done by direct interference must be left to time; or the sick person, when circumstances allow, must be removed to a high situation, when the most important vegetative functions of the body are facilitated, and thus less is required from the reduced organism. One very important point is the condition and individual requirements of the mind, which, owing to the endurance of the sickness and to bodily weakness, is for the most part over-

irritable, and needs indulgence no less than the physical organism; the alternative mentioned in the first book, p. 24, of either diversion or collectedness, is in this case the point to be decided. Combined with retarded convalescence, special complications frequently appear, requiring special means and methods; for instance, a great degree of anæmia, spinal irritation, catarrh of the stomach and intestines, bronchial catarrh, enlargement of the liver and spleen, &c. A careful diagnosis of the case must above all decide the question whether and what essential share the complication has in retarding convalescence, and how far it is permissible to attack the latter alone or predominantly, in order subsequently, when the reactionary and resisting power of the organism is restored, to tax the organism with the direct treatment of the complications, or whether immediate attention to the complicating state forms the necessary condition for facilitating convalescence. In the latter case also, the maxims of delicate treatment must, generally speaking, be observed; iron must only be used in considerable anæmia proceeding directly from the loss of blood, fibrine, or albumen; and in the treatment of a catarrh, preference must be given to common salt, with its conservative character, above carbonate of soda; and in enlargement of the spleen and liver, this same common salt is to be preferred to the waters of Carlsbad, Marienbad, and others containing Glauber's salt and soda. These are only examples; but the object of our whole work is to lay down principles which may render each simple case of treatment a plain example of the doctrine.

If, as we have mentioned above, in most chronic states of illness, the indications of retarded convalescence possess an important significance in *addition* to the *indicatio morbi*, there are, on the other hand, certain *general conditions of weakness* which have essentially to be estimated and treated like retarded convalescence; namely, defective development in childhood, phthisical tendencies, premature old age, general emaciation consequent on distress and agitation of mind, considerable atrophy in the latter part of pregnancy, habitual abortion, and the like. Here also strongly stimulating and depleting or reducing

Condi-
tions simi-
lar to
retarded
conva-
lescence.

methods, courses of iron especially, are to be excluded, and the milder forms of the thermal system, such as sool-baths, moor-baths, and gaseous thermal sool-baths, are indicated, combined with general attention to the regimen; and in these cases also, when attended with catarrhal complications, common-salt-waters or muriatic alkaline springs are to be preferred to pure and stronger soda-waters.

Anæmia.

In the treatment of *Anæmia*, the mode of its origin is an important point; whether it be caused directly by loss of blood and of the component parts of the blood, or indirectly by the loss of other juices, and from the atrophy attending long illness. The more the first cause preponderates, the more is the direct use of iron indicated; in the other case, the use of iron is superseded by the indirect remedies of strengthening treatment. Even in direct anæmia, the use of iron often requires great caution, and the alternative arises as to whether steel-springs or pharmaceutical preparations are to be preferred. In the indirect treatment of anæmia, the cold-water system is but rarely suitable, and then only in the slightest cases. The milder forms of the thermal system are, however, universally indicated; baths of every sort, especially sool-baths, in many cases sea-baths, and above all, as a medium between these two, gaseous thermal sool-baths. We repeat the statement that so-called steel-baths are not to be considered as an iron remedy, but only as baths containing a more or less strong amount of carbonic acid; that real anæmic paralysis much more rarely occurs than might be supposed from its mention in literature; and lastly, we may also here observe that, in the treatment of special complications, the preference is due to common-salt-waters above soda and Glauber's salt-waters, which diminish substance; and that the sulphuretted hydrogen of sulphur-waters produces a certain degree of anæmia, owing to the direct removal of iron from the blood of the portal vein.

Basedow's disease.

Basedow's Disease [Graves's disease or exophthalmic goitre] is in many cases ameliorated by the use of iron, and in others not so; and the same may be said of constant flooding. In cases of *scrofula*, the alternative presents itself between the strengthening and absorbing treatment,

Scrofula.

which we have already brought forward as the general distinction between Rehme and Kreuznach (p. 221). All the forms of the thermal system may be used, all the cooler the more a tonic effect is required, and the warmer the more an absorbing effect is aimed at. The sool-bath forms, therefore, a medium and ordinary form for use, because it slightly stimulates the change of substance, and yet allows a cooler bath temperature; in both respects the gaseous thermal sool-baths of Rehme and Nauheim may be regarded as higher types of the simple sool-baths. The ideal, however, of a mode of treatment adapted for scrofulous constitutions by increasing the productive part of the change of substance, is the sea-bath. For absorbent treatment, besides the more stimulating baths of the thermal system, there are courses of common salt, soda, and Glauber's-salt waters, and above all, the use of iodine; common-salt-waters are especially indicated when, in consequence of catarrh and ulcerations of the glands and bones, the necessity arises for bringing to maturity large pathological cellular products, and for compensating for the loss of organic substance and of chloride of sodium thus caused. The anæmia which, in advanced cases of long standing, almost always accompanies scrofula, is of a very indirect character, and admits but rarely of the use of iron.

Syphilis falls only to a limited extent within the Syphilis. range of balneotherapeutic treatment. For the elimination of the poison in obstinate secondary and tertiary cases, periodical courses of mercury and iodine are indispensable; and the forms of the thermal system as well as lixiviating courses of mineral waters only serve to produce a gentle stimulation of tissue-change during the intervals, and also to counteract the injurious effects attending those powerful modes of treatment. The cold-water system possesses greater importance; its strongly stimulating and lixiviating forms may be, on the one hand, used instead of the above-mentioned pharmaceutical remedies, in order to spare the already threatened constitution the injurious effects of such ever-poisonous remedies; and on the other hand, the milder tonic form of the cold-water system

appears of important assistance in the numerous cases in which weakness of skin has been produced by mercury, iodine, Zittmann's decoction, and by great warmth of bed and room. Generally speaking, such a great degree of cachexia results from syphilis of long standing and variously treated, that most persons suffering from it are obliged to be extremely careful in the choice of restorative and curing remedies; hence sea-bathing combined with sea-air is much more rarely had recourse to, than a prolonged residence in summer in elevated situations, and in winter in a southern climate. Lastly, we must once more mention the groundlessness of the assertions that sulphur-baths are a specific remedy for the cure of syphilis, and for manifesting latent dyscrasia.

Metallic
poison-
ings.

Chronic Metallic Poisoning is, like syphilis, the subject of balneotherapeutic treatment, though in a still more limited measure. Its direct indication is to produce the lixiviation of the blood and the stimulation of secretions, and as the deposit of these poisons predominantly occurs in the substance of the liver, it is designed to increase the secretion of bile. The means usually adopted are courses of simple water, of sulphur-waters, and of mild soda and Glauber's-salt waters; the exciting forms of baths belonging to the cold-water system; and, in individuals requiring indulgent treatment, the milder forms of the thermal system. The accompanying anæmia frequently requires careful regimen, and admits the cautious use of iron.

Gravel.

The conditions which are characterised by *Gravel* partly fall under the head of gout and plethora of the abdomen and of the so-called venous conditions; and, as such, require the corresponding regimen. In the direct treatment of the symptom in itself, lixiviation of the blood, acceleration of the change of substance and the secretion of albumen are necessary; and we have only to repeat that soda-waters containing carbonic acid are for the most part better able to be borne than courses of plain water, and further, that soda-waters containing Glauber's salt, such as Carlsbad, Marienbad, and Tarasp, produce a still stronger effect in secreting albumen, and

that the latter spas all the more deserve the preference, the more the case requires a strong stimulation of the retrogressive change of substance and a diminution of excessive formation of fat.

In cases of *Gout*, especially in irregular forms of the Gout. disease, the most important and practical point is the *careful prognosis* of the individual case (pp. 74 and 116). It is only by limiting the prospect to what is possible, that tolerable results can be obtained; but this possible improvement is in itself very limited. The direct *indicatio morbi*, which requires lixiviation and absorption, finds its suitable remedy in courses of soda-waters, common-salt-waters, and Glauber's-salt waters. Vigorous thermal and cold-water treatment almost always meets with dangerous impediments in the general exhaustion and cachexia of the sick person, and in complications, especially those of heart affections. As an assistance to this direct treatment, or for exclusive application in those cases in which a judicious prognosis limits the treatment to the improvement of the general health, the mild forms of the stimulating thermal system are useful, namely, indifferent thermal, especially the highly situated (Wild-bath) sool-baths and gaseous thermal sool-baths; but sea-bathing and the sea-air are rarely allowable.

In *Chronic Rheumatism* it is necessary to promote the Rheuma- absorption of exudations, and thus in each individual case tism. the choice must be made from a great number of absorbent remedies. The more extensive the exudations and the longer their standing, and the more they affect the joints and their vicinity, instead of the muscular substance, the more vigorous must be the method used. The strongest remedy is the stimulating and lixiviating form of the cold-water system; and next to that, when the latter is prohibited by complications, the stronger forms of the thermal system; and lastly, holding a medium position between the two, sool-baths, thermal sool-baths, and moor-baths. Sea-bathing is only indicated in muscular rheumatism; in articular rheumatism of any importance, it is decidedly contra-indicated. In most cases of muscular and articular rheumatism, the accompanying weakness of skin

affords an important symptomatic indication, attention to which, in slighter cases of no long standing, is very frequently sufficient for a radical cure; it requires the tonic forms of the cold-water system, cool sool-baths, cool thermal sool-baths, sea-bathing, and hardening regimen. The so-called *rheumatism of the bowels* is nothing more than a metastatic congestion after colds, and it requires attention to be paid to the causal indication, namely, the removal of the weakness of skin. *Nervous rheumatism* denotes either the rheumatic affections of nervous persons, or very frequently conditions which have nothing in common with rheumatism, namely, spinal irritation, spinal meningitis, neuralgic periods in the course of tabes, and other diseases of the spinal marrow. Among these latter may be reckoned very many cases which are often erroneously designated as rheumatic paralyses, whilst this name is only deserved by those cases in which either a paralysing of the nerves is caused by a rheumatic exudation in or about the sheaths of the nerves, or atrophy of the muscular substance is produced by the same cause; in both cases, the strongly exciting and absorbing forms, and especially the local use of the thermal system, are useful, frequently combined with local remedies and especially with the application of the galvanic current.

Exanthemata.

In cases of *Chronic Exanthemata*, it is urgently necessary for the present, so long as the effect of old prejudices and of an unjustifiable literature on the subject lasts, that the belief in sool-baths and sulphur-baths should not gain ground among beginners in medical practice. Exanthemata demand specific modes of treatment, and among these are the older methods of Priessnitz, wet sheets and bandages and warm baths for hours at a time, such as are usual at Leuk, and are also occasionally employed by Hebra (p. 112); the former in cases of psoriasis, the latter in eczema. Eczema is a *noli-me-tangere* for sool-baths, and furunculosis usually for all sorts of baths. The cold-water system is suitable only for seborrhœa, local perspirations, urticaria, pemphigus, purpura simplex, and occasionally in its quieting forms for alleviating irritation in eczema. Acne rosacea, acne disseminata, prurigo, and psoriasis are

successfully treated with sulphur, though not with sulphur-baths, but with strong pharmaceutical preparations.

The conditions which correspond with the idea of *Plethora of the Abdomen* are divided in individual cases into the two groups of the *corpulent* and the *lean* hemorrhoidal type; and from this distinction the treatment, and especially the choice of the general measures, must emanate; in the former, generally speaking, a laxiating substance-diminishing treatment must be observed, and in the latter a strengthening and delicate treatment. The use of cold water is indicated as an important dietetic remedy; but true cold-water treatment is principally to be recommended in cases where hypochondriasis predominates, and in these as a principal remedy. Warm baths act only symptomatically, as they prepare the skin for a better circulation of the blood, especially soot-baths, and, as a more active kind, thermal soot-baths, the effect of which often manifests itself in hemorrhoidal bleedings. Strong sulphur-waters, such as Weilbach, are used principally in hemorrhoidal enlargement of the liver. Soda-waters containing Glauber's salt are used in the same cases, and in general are effective in counteracting corpulence and retarded change of substance. Simple soda-waters, often designated as 'mild Carlsbad,' are only adapted for slighter cases, especially for the so-called venous condition of women; on the other hand, common-salt-waters have a wide range of action, partly on account of the effect of the chloride of sodium in promoting the change of substance, and yet in facilitating the formation of cells; partly on account of the other component parts, the sulphate and carbonic acid. The grape-cure is always a doubtful remedy, too weak in very corpulent persons, and too strong in atrophic and dyspeptic cases. In many slighter cases it is suitably employed, but, of course, not with southern and excessively sweet grapes. The whey-cure also, combined with very careful diet, may be here employed. It remains, however, doubtful how much of the effect is due to the spring, to the forest-air, exercise, &c.

Plethora
of the ab-
domen.

In *Liver-diseases* one general point has in many cases

Liver-
diseases.

to be considered, namely, the question as to the increase of the secretion of bile. There do not seem to be any specific pharmaceutical remedies for this purpose, in spite of the rich apparatus of the specific schools of Rademacher and the homœopathists. A stimulation of the secretion of the liver is effected either indirectly by irritating the stomach and small intestine with calomel, rhubarb, jalap, and other medicaments, the irritation being sympathetically carried on to the liver; or by plentiful drinking of water, which, like all other secretions, thus increases the secretion of the bile and of the component parts of the bile. Whether the carbonic acid and the soda of alkaline waters directly increase the bile is still very doubtful, and equally so is the question whether the Glauber's salt of the Carlsbad and similar springs, as well as the other sulphates, produce any other but the indirect effect alluded to. The same may be said of common salt. All these waters have, moreover, when rightly indicated, their effect in improving digestion and defæcation, and in facilitating the circulation in the portal vein, and thus of acting indirectly in freeing the function of the liver. Soda-waters, and those especially which contain Glauber's salt, may, moreover, promote the secretion of a bile deficient in fat, and may thus tend to diminish gall-stones. Icterus catarrhalis requires, of course, the anticatarrhal remedies, soda and common salt, and this without any prospect of a very rapid result. In cases of simple and hemorrhoidal hyperæmia of the liver, stronger sulphur-waters, soda and common-salt-waters, containing Glauber's salt, may be used according to the maxims already laid down at length. Chronic inflammation may only be treated antiphlogistically, and great caution is required in the use of mineral waters. Nutmeg-liver affords, generally speaking, a very bad prognosis, and those methods which improve the general health are necessary to check its progress; cirrhosis and lardaceous liver can only in the early stage be subjected to a mild course of mineral waters, especially of common-salt-waters and soda-waters containing Glauber's salt.

Spleen-
tumours.

Simple Spleen-tumours are sometimes, from analogy with hemorrhoidal enlargements of the liver, treated with

common-salt-waters and soda-waters containing Glauber's salt; and sometimes, if accompanied with considerable anæmia, the use of iron is indicated; and frequently, if attended with intermittent symptoms, the use of quinine. Among suitable baths the moor-baths seem to deserve the preference, though this is purely empirical.

Chronic Catarrh of the Stomach requires, above all, its certain diagnosis and distinction from dyspepsia and atony. The latter very differently caused conditions require both local remedies, such as carbonic acid, cold, iron, and very mild common-salt-waters, and general remedies, such as diet and sea-bathing. True catarrh of the stomach is a disease severe in itself and in its consequences, and in no wise so frequent as its confusion with dyspepsia, atony, and ulcer of the stomach would lead us to suppose. Among mineral waters, mild common-salt-waters, up to the amount of those of Kissingen, are indicated as the principal remedy, and especially warm; and hence the well-grounded reputation of the Wiesbaden Kochbrunnen. Also slight soda-waters containing Glauber's salt, like Carlsbad, frequently prove successful, especially in cases in which the complication of a sluggish function of the bowels requires a very mild aperient remedy. Frequently, however, mineral springs cannot be borne, or they do not accomplish their purpose; and in this case the treatment must be limited to pharmaceutical and general remedies, such as nitrate of silver, acetate of zinc, mountain-air, diet, and others. Sea-baths and sea-air are generally beyond the powers of the invalid suffering from real catarrh; iron, whey, and grape cures produce direct and local injury.

Catarrh
of the
stomach.

Catarrh of the Bowels is only in rare cases a subject for medicinal waters. It requires for the most part very strict treatment with pharmaceutical remedies. Although preparations of iron are among these, iron-waters are not generally able to be borne; weak warm soda-waters (without whey!) are the most enduring in their effect, and weak warm common-salt-waters may be used in those cases in which it is necessary to supply the irritated intestinal membrane with a well-prepared chyme. Many

Catarrh
of the
bowels.

cases, moreover, may be classed among the indications of *weakness of skin*, when the catarrh of the bowels is nothing more than an often-repeated congestion of the intestinal membrane arising from great susceptibility of skin.

Ulceration of the stomach.

Chronic Ulceration of the Stomach rarely justifies a trial of medicinal waters, especially of those containing carbonic acid, and, least of all, a course of sea-baths, on account of the great tendency to bleedings. Pharmaceutic and expectative treatment frequently, in course of time, prove successful in a condition which is only capable of slow improvement, and is always subject to relapses. Iron must only be used with great caution, even if there be much anæmia.

[In several cases under our observation, the carefully arranged diet has been materially supported by mild courses of Carlsbad, the effect being probably due to unloading of the bowels and of the portal circulation.]

Bronchial catarrh.

In *Catarrh of the Respiratory Membrane*, apart from all complications and etiological circumstances, it is necessary to bring the product of the disease to maturity, as is the case in all other catarrhs. The means for effecting this are *par excellence* soda and common salt; hence soda-waters containing common salt are the most used. The carbonic acid scarcely assists in directly meeting this indication, i.e. in increasing the alkalescence of the blood, though the water in itself does so. Compared with the remedies just mentioned, the ordinary whey and grape cures, both in practice as well as in theory, hold a very inferior position, and their effect proceeds in a great measure from the accompanying and general influences of the cure; the good effect of Lippspringe is a purely empirical fact. Vapour-baths, steam-baths, and inhalations are important local remedies; sulphur-waters have only been tested in consumptive conditions, based on hemorrhoidal tendency. Mountain-air seems, in the greater number of cases, to deserve the preference over sea-air; yet there is no lack of very decidedly opposite experiences and assertions.

Much the same may be said with regard to *Catarrh of*

the Bladder, as we have just stated with regard to bronchial catarrh; only in this case, in addition to simple and muriatic soda-waters, weaker and especially warm Glauber's-salt waters, such as Carlsbad, may be used, the indisputable effect of which possibly arises from the facilitation they afford to the pelvic circulation. The reputation of Wildungen is not theoretically explained, and it perhaps proceeds predominantly from the increased diuresis produced by the waters.

Catarrh of the bladder.

The indications for the treatment of *Pulmonary Phthisis*, are up to the present day but little explained, and they contradict each other so much that only a statement of them connectedly, and not a short epitome, can be any guide respecting them.¹

Pulmonary phthisis.

In *Diabetes*, the distinction of the genuine from the symptomatic form is important, especially for the just appreciation of success or failure in the individual case. As a specific remedy, in order to effect an improvement in the sugar secretion and to check it, there is only *one* thing known, namely, a very carefully conducted course of Carlsbad or Vichy waters; other similar soda-waters, and soda-waters containing Glauber's salt, have been hitherto but little tried, and the experiences and observations on the matter are very uncertain, because frequently in the last stage, and with pulmonary phthisis strongly developed, the hopelessly sick person is subjected to the hazardous treatment of a course of mineral waters.

Diabetes.

Various Exudations, Tumours, Diseases of Bone, Sequestrum, and the like, if they be cases for Balneotherapy, demand partly the amelioration of the complicated or etiological general malady, according to the principles laid down with regard to retarded convalescence, scrofula, and similar conditions; partly, and this in the greater number of cases, the object of the treatment must be to increase the general change of substance, and to affect the local disease through the generally increased and improved tissue-change. The choice, amid the great number of means and methods available for this purpose, in the cold-water system, the thermal system, courses of mineral

Exudations, bone-diseases, tumours.

¹ See following book.

waters, can only be regulated according to the individual characters of the case. There are, however, conditions in which very frequently baths and courses of waters have been prescribed without the slightest prospect of success, to the injury of the sick person, or at any rate with a useless expenditure of money and time. Ovarian tumours and hypertrophy of the tonsils are never removed by baths and waters, but only by local remedies or by the knife, and the same may be said of tumours in the mammary glands. Chronic orchitis is occasionally improved, although only partially, by vigorous courses of sool-baths and sulphur sool-baths. Fibroids of the womb yield to no method, and chronic infarction of the uterus is very rarely cured; and as regards it, as well as chronic metritis and fluor albus, all balneotherapeutic treatment may rather be considered as an adjuvans and roborans.

Neuroses. With regard to *Neuroses* we may make the following
Hypochondriasis. résumé. *Hypochondriasis*, setting aside the necessary treatment of its causal influences, generally requires stimulating, strengthening, and hardening methods; the cold-water cure is the principal remedy, and next to it sea-bathing, physical and psychical exercise, change of scene both for body and mind, marriage, compulsory attendance to business concerns, and the like. Generally speaking, the malady should be treated as a psychosis.

Hysteria. In cases of *Hysteria* also, the cold-water system is the main remedy, but the prognosis is worse than that of hypochondriasis.

Spinal irritation. *Spinal Irritation* affords in general two indications, which may in some measure be met together, and in some measure after each other; namely, the irritation may be soothed by narcotic means and by the use of the cold-water and thermal systems, according to the individual character of the case and the sick person, and the irritability may be diminished by a general tonic treatment. Most persons suffering from this disease belong to the class of invalids requiring delicate treatment, and sea-bathing and sea-air are less frequently advantageous than residence in elevated situations.

Neuralgia. Cases of *Neuralgia* in no wise afford the grateful

material for balneotherapeutic treatment, boasted of in balneological literature, unless every condition of muscular rheumatism be regarded as neuralgia. Neuralgia of central origin is either a symptom of spinal irritation, and is accordingly to be treated as such, or it is a symptom of tabes and other diseases of the brain and spinal marrow. Peripheric neuralgia, for example, of the sciatic, trigeminus, or intercostal nerves, yields but rarely to bath-treatment, either cold or warm, but it requires local remedies, and a prolonged use of specific remedies taken internally. *Hemicrania* seems most accessible to the effect of sea-baths.

Epilepsia, Paralysis Agitans, and other forms of convulsions should, as is proved by satisfactory experience, no longer be made the subject of bath-treatment; in chorea alone, the mild forms both of the cold and thermal system may be allowed, and this on the principles laid down as regards impeded convalescence or spinal irritation.

Epilepsy;
paralysis
agitans;
chorea.

Psychosis is very often suitably treated with baths, though not at bathing resorts, but at lunatic asylums.

Psychosis.

Paralysis of the will and intelligence, a few cases of which have been mentioned, unaccompanied with delusions, admits of treatment at ordinary spas.

Paralysis from Exhaustion of the Spinal Marrow does not belong to true specific paralysis, but presents rather the phenomena of general paralytic weakness, and is suited to the treatment used in retarded convalescence: namely, all the forms of the thermal system in addition to the regulation of the regimen; and, generally speaking, gentle treatment is to be preferred to violent interference, as the prognosis, setting aside possible complications, is thoroughly good.

Paralysis;
exhaustion of the
spinal
marrow.

So-called Anæmic Paralysis is to be classed, as a rule, also under the head of paralytic weakness, combined with a considerable degree of anæmia, and it is treated on the same principles.

Anæmic
paralysis.

Hysterical Paralysis represents a specific form of disease, and, in spite of considerable paralysis and tonic contractions, it affords a tolerably good prognosis. Yet the cold-water system which forms the main remedy in

cases of hysteria, is not to be recommended in these forms, but the thermal system in its exciting forms or the constant current.

**Typhoid
paralysis.**

Typhoid Paralysis and atrophy of certain extensor muscles of the lower and even of the upper extremities, is a perfectly specific form of disease, in the treatment of which the principle must mainly be kept in view as to the necessity of preventing the fatty degeneration of the muscles concerned, by powerfully stimulating forms of the thermal system, and by the galvanic current. The same may be said of paralysis caused by lead.

**Lead-
paralysis.**

**Rheumatic
paralysis.**

Rheumatic Paralysis, which really deserve this name, are of a peripheric kind, frequently combined with muscular atrophy, but not with fatty degeneration; they require the stimulating and especially the locally exciting forms of the thermal system, and particularly the galvanic current.

**Shock to
the spinal
marrow.**

Paralysis proceeding from a Shock to the Spinal Marrow (but without injury to the vertebral column), resembles hysterical paralysis both in its form and prognosis, and is treated in a similar manner.

**Reflex
paralyses.**

Reflex Paralyses in Romberg's sense, occurring more frequently in men than in women, and most often emanating from diseases of the bladder and the prostate, and from trophical liver-affections, appear, generally speaking, in the form of tabes dorsalis, and are treated in a similar manner; their prognosis, however, is far better than that of tabes, and in their case, in distinction from the latter, the cold-water system is not excluded.

**Spinal
paralysis
of chil-
dren.**

Apoplexy of the Spinal Marrow, most frequently observed under the form of the spinal paralysis of children, and as a local residuum of some definite post-catastrophe, not affecting the general health, is only in one respect a subject of treatment; namely, as regards the checking of the fatty degeneration of the threatened groups of muscles, and thus of restoring the better use of the paralysed limb with or without the help of mechanical apparatus. Strongly stimulating thermal treatment may be used, and especially faradisation.

lysis

Paraplegia caused by the Pressure of an Exudation

after *Spinal Meningitis* affords, when it is recognised in time and properly treated, a thoroughly good prognosis, in spite of the severe character of the symptoms. In the inflammatory stage, strong antiphlogistic remedies are required, occasionally also *secale cornutum*; and subsequently, for the promotion of absorption, recourse may be had to suitable forms of the thermal system, combined with electrical treatment of the muscles, in order to protect them from atrophy. *Diphtheritic paraplegia* affords a thoroughly good prognosis for the use of the stimulating forms of the thermal system. [In some cases of this form we have also seen good effects from the shock of the waves in sea-bathing, and in others from douches.]

spinal meningitis.

Diphtheritic paraplegia.

Hemiplegic Paralysis, when it has lasted for more than a year and is accompanied with contraction, has little to expect from Balneotherapy, except an improvement psychically and physically of the general health, produced by the cooler forms of the thermal system.

Hemiplegia.

Tabes offers a great choice of remedies and methods, which here need not be recapitulated, because the paragraph on the subject in the second book was in itself only a *résumé* of the practical survey of the subject.

Tabes.

Paralyses arising from softening of the spinal marrow, from continued chronic inflammation of the medullary matter, from softening of the brain, and the like, are capable of no improvement from the use of baths; and these, if they be tried as a palliative and for the improvement of the general health, on the same principle as in cases of retarded convalescence, require great caution and delicate management.

Incurable paralyses.

Peripheric and Traumatic Paralyses, and Paralyses caused by the Pressure of Pathological Tumours require, in addition to causal treatment, the strongly exciting forms of the thermal and cold-water systems, according to the capability of the invalid. A certain amount of patience is called for on the part of the physician, because frequently, after long interruption of the conducting power, innervation is restored to a certain extent, as has been observed even in complete paraplegia produced by fractures of *vertebræ*.

Peripheric paralyses.

BOOK IV.

PATHOGENESIS AND THERAPEUTICS OF CHRONIC
PULMONARY TUBERCULOSIS. By Dr. LOUIS BÄCKSTRÖM, Med.
Physician at Lund.

SINCE the appearance of the second edition, in which I attempted to give the practitioner a brief sketch of phthisis, this subject has been cultivated with great zeal. The severe but true remark of E. Wagner, that 'chronic tuberculous disease is the stepchild of clinical lecturers, and accordingly also of practical physicians,' may possibly lose its applicability at no remote period. The 'exact' anatomically established ground obtained a few years ago, has shifted itself again, and with it many deductions of the clinical lecturer who builds only upon established facts, and who thinks himself compelled to condemn as heresy each return to less 'exact' empiricism. As regards medical practice, the modest ground must remain, which we before pointed out as the safest; namely, to make the starting-point of our observations those instances which meet us *in vivo*, but which will not submit to the narrow limits of microscopically defined conditions. I forbear, therefore, intentionally from making any statement of anatomical distinctions, and I shall only mention them occasionally when they throw light upon practical questions. I shall devote somewhat greater space to the physiological aspect of phthisical causes, in order to give a foundation for those therapeutic measures which this work is intended to recommend. As in the original work, home-treatment shall not be neglected, as it has long been both by physicians and by non-physicians. In this respect we may recommend Paul Niemeyer's works as full of merit: 'Atmiatrie'¹ and 'Principles of a Radical Cure of Phthisis.'

¹ Erlangen, 1872.

In the first place we will say a few words as to the name of our subject, 'pulmonary consumption, phthisis.' I chose it intentionally, because none of the other designations comprises the whole complex range of affections forming the subject of our work. The name 'tuberculosis' is familiar to the younger amongst us only as a peculiar species of the genus phthisis, and 'chronic pneumonia,' as many persons besides F. Niemeyer denominate every case of apparently curable phthisis, is likewise only one of those affections which can produce phthisis. Every separation of these affections *intravitam* is artificial. On the other hand, all, from genuine tuberculosis with its cellular growth in the smallest vascular sheath and the mucous membrane, sometimes rapidly fatal from the intensity of its poisonous productions, to the extensive mechanical destruction of the respiratory organs from chronic pneumonia of various kinds,—all agree clinically in the one point, that *they are calculated each in itself, or more frequently in combination with each other, or lastly in distinct individual circumstances, to endanger life or dangerously to depress the general health, by diminishing the substance of the lungs or their capability of breathing.* Only for external reasons, we forbear for the present to treat at the same time of other chronic lung-affections, especially of emphysema and the like, which nosology only is justified in separating from the rest, as *generically* differing from phthisis.

CHAPTER I.

PRELIMINARY NOTIONS—ETIOLOGY—PHYSIOLOGY OF PHTHISIS.

Phthisical
disposi-
tion.

IN estimating each individual case, in phthisis least of all diseases, is the result of objective investigations sufficient. In the first place an inquiry should be made as to a *disposition* to the disease. Our definition of this is: innate or acquired weakness of the organisation proceeding from too slight a capability of resisting injurious influences, excessive reaction, imperfect compensation of the injury caused, and therefore also an inclination for acute affections to become chronic, a tendency 'to a large production of indifferent and decaying cells' (Felix Niemeyer), and 'to respond to slight irritation by unusually cellular and inflammatory exudations' (Buhl). I must permit myself a short discussion on the subject, and for this purpose I must make a few remarks upon general pathology. At page 15 *et seq.*, reference was made to relative health and its conditions. The more this is developed, the easier and the more complete is the adjusting of occasional derangements; the less it exists, the slighter is the capability of adjustment, and the more difficult the return to a normal condition. The healthier, however, and consequently the more vigorous the individual, the less apparent is the immediate reaction (*reactio* as the response to the influence, *actio*), whilst excessive reaction, the resistless submission to the irritation, is the characteristic of weakness. The contrasts before us are therefore strength, by which we mean relative health with regard to its power of compensation, and *feebleness*. Feebleness has not the same meaning as weakness; weakness may be a temporary phenomenon of strength, but it is always a property of feebleness, and is permanent in the latter. Feebleness is

Feeble-
ness.

frequently innate, it is only nullified by great consistency of habit, and it is often acquired, and this not by one act of over-exertion which weakens the strength only for the time, but by continued exertion, which is not repaired and which is not reparable, owing to a constant disproportion between receiving and giving out. Weakness is the expression of a result of acute illness; feebleness may result from it, but it is always the consequence and accompaniment of chronic illness. It may be local or general, but it is always characterised by *imperfect or absolutely deficient compensation of pernicious influences*, by excessive reaction consequent on them, manifested in the highest degree by the failing of all the functions of the body, and in the slightest degree by affections of which the vigorous organism is ignorant, or which it knows only superficially. Feebleness can, lastly, be caused by the circumstance that the individual shuns the irritations for some time, to which another is daily and hourly subjected, and which consequently suit him. A feebleness of this kind seems, in the present stage of our knowledge, to be indispensable to the development of phthisical diseases; whether, therefore, they may be called constitutional, manifesting themselves by localisation in the lungs, is of less importance. For our present purpose, the knowledge of the causal connection between the innate or acquired debility of the organism and the local affection, allows us to draw the practical inference that the former also may be a point of attack for our therapeutic efforts.

When this debility is innate and is not diminished by physical education, the more or less distinct stamp of a phthisical habit or conformation presents itself to our view. The thin slender bones, the feeble muscular structure, and especially the narrow thorax, assist a rapid diagnosis, and as a prognosis also they give rise to the thought that an origin or mode of life which could cause the construction of such a bad framework, may have contributed to the development of an unsatisfactory condition of the organs contained in this framework, though this may not be for the moment apparent. A *transitory disposition* appears when, after acute illness and loss of juices, anæmia and

Phthisical
conforma-
tion.

weakness of the heart are left behind. Lastly, to the medical practitioner, those *chronically affecting causes* are in the highest degree worthy of attention which, as bad and weakening circumstances of life, produce the disposition in the most numerous cases of phthisis; above all, the inhalation for years of bad air,¹ insufficient bodily exercise, deficient nutrition, numerous confinements, exhausting chronic diseases of other organs, such as catarrh of the stomach and diabetes, and lastly, modes of life which induce, like trades connected with dust of different kind, the introduction of noxious particles into the lungs.

Hereditariness.

All these kinds of disposition are so far *hereditary*, that a weakness is conveyed to the children similar to that possessed by the parents at the time of their birth. The popular supposition that phthisis arising from an hereditary disposition is to be feared on account of its obstinate character, seems to be confirmed by the experience of medical practice. If broad-shouldered portly people become phthisical, there is usually an hereditary disposition existing, which for the most part expresses itself first in the weakness of different organs, particularly in the ready bursting of small blood-vessels. On the other hand, phthisis arising from a disposition produced by long-continued injurious influences appears disproportionately more malignant and rapid in its course than the former. Only those cases of phthisis which proceed from the inhalation of dust of various kinds are an exception, as these generally affect vigorous people.²

Paralytic thorax (the depression of the lower ribs towards the abdominal cavity) appears in all consumptive diseases, and it is therefore only conditionally to be employed in the diagnosis. Phthisical disorders of the lungs occur, as is well known, at *all ages*; but from the earlier maturity of the female body we find *male* persons subject to the disease principally from 21 to 28, and *females* before 20.

Climate as a cause.

Climate has only so far an influence, that from its variations it causes injurious effects which are likely

¹ See H. Mac Cormac, *Consumption as engendered by Rebreathed Air*.

² See Zenker's *Diseases from the Inhalation of Dust*.

to disturb the equilibrium in the organism exposed to them. Weak persons lose this equilibrium more easily, and they cannot so readily compensate for the derangement caused as vigorous persons can. To them, therefore, a climate is all the more dangerous, the more sudden and sharp the variations to which they are exposed by it; and the more frequent, therefore, the possibility of illness which *under the influence of the existing disposition* is apt to lead to deleterious changes. Moisture of air, much found fault with as it is, is in itself no generic influence, any more than moisture of soil. The interesting investigations of Bowditch and Buchanan only prove that phthisis thrives with stagnating dampness of soil; and the latter appears as generally adverse to health in the above list of the bad and weakening circumstances of life.

The question recently emphatically stated as to the immunity of a place (the non-appearance of phthisis in it) has but every partial value as regards the treatment which considers complex origin of the forms of the disease. Wise prophylaxis would prefer, of course, under similar circumstances, those districts in which phthisis is rare; but the non-appearance of phthisis in the natives of a place will never afford the unbiassed physician a convincing reason in the treatment of an individual case of disease, which has arisen on a totally different soil and has developed itself under totally different circumstances. Mention is made of localities free from the disease, because the cause of the absence of phthisis is sought for in climatic peculiarities. This point must, however, give way, since a number of districts with the most heterogeneous climates are mentioned as free, and since phthisis, with the advance of industry, has shown itself more constantly even in districts considered free. There are, therefore no 'immune climates' in the strict sense of the word, but only 'immune populations,' i.e. *populations the members of which possess no disposition to phthisis*, so long, and only so long, as they remain true to their native habits. All the races in question have been for centuries complete in themselves; they draft off

Immunities.

stratified areas of population they receive but slight additions in variety and this only recently, and they thus form apart in themselves a great family consisting of individuals more or less resembling one another. This resemblance renders itself clear in the fact that the organism has little tendency to phthisical affections. The origin of this freedom is not wonderful, when we know that the climates in question are not adapted for allowing those weakly born to be brought up, or that they possess the property of more quickly and completely rejecting the passing condition of weakness following after illness, by facilitating the change of substance, than is possible under other atmospheric circumstances. Thus I consider the endemic and geographically limited freedom from a phthisical tendency as a peculiarity of race acquired by natural selection. Like all similar peculiarities of race, this immunity decreases when individuals of the race which could only under special circumstances be thus and not otherwise formed, are withdrawn from these special circumstances which thus have been lived in for centuries. It is only in accordance with other facts, and especially with those observed in negroes and monkeys with regard to phthisis, if the inhabitants of so-called immune districts are far more inclined to phthisical disease in other lands than the natives themselves. Even this peculiarity speaks in favour of our supposition, as it is proved that an injurious influence all the more strongly affects the body, the longer and closer the latter had remained hitherto in its own defined and narrow groove. The therapeutic use of the districts marked by this freedom from phthisis is not denied by these considerations. I fully admit here the fact, that some of the 'immune' districts are distinguished by climatic peculiarities which are possibly unfavourable to the development of phthisis, and to which certain cases may with advantage be subjected. The inference, however, which is drawn by the fanatical advocates of an atmospheric agent hostile to phthisis—namely, that the immunity of a place is the one sound criterion for its choice as a residence in cases of phthisis—is untenable, even if we were to

forget that a variety of pernicious influences produce phthisis and can decimate the badly situated inhabitants of places, in which the invalid sent thither can dwell without injury, because he does not come into contact with these injurious influences.

The alleged *immunity of heart-diseases and emphysema* from phthisis has absolutely no existence. Cheesy pneumonia is excluded (according to Traube) by none but those affections of the heart in which the flow of the blood from the pulmonary veins into the heart is impeded; cases of narrowing of the pulmonary artery or of its orifice are, on the other hand, much disposed to it. The fearful condition of a high degree of emphysema is practically almost equivalent to chronic consumption. Moreover, cases of miliary tuberculosis occur in emphysema.

A far greater difference, clinically and anatomically, than that between chronic phthisis and emphysema, exists between chronic phthisis and *acute miliary tuberculosis*, an affection which without hesitation may be ranked among infectious diseases, and which forms no subject for Balneotherapy. This miliary disease does not seem to concern itself at all about 'zones of immunity;' at any rate, a small Spanish work expressly states of Jauja, a place situated in the Andes more than 10,000 feet high, that recently a great mortality among the natives of the country from acute tuberculosis has been ascertained. *Miliary tubercles to a limited extent* are frequently to be met with in phthisis, and their prevalence compared with processes of ulceration gave rise to the denomination of chronic miliary tuberculosis. Probably in both forms the essential point in their origin consists in entrance of minute elements into the circulation, especially by means of the lymphatic vessels. Tubercles, however, do not always arise from the absorption of such material; on the contrary, here also the existence of a disposition, perhaps even of certain local conditions of the lungs, seems to be necessary. The cases are frequent in which, during the absorption of an internal abscess, indubitable hectic symptoms may be perceived, such as fever, night-per-

Miliary
tubercles.

spiration, cough, and emaciation, and these vanish without leaving a trace behind after the absorption is completed. Almost without exception, those cases of phthisis are very malignant which proceed from the absorption of cellular elements from *degenerated scrofulous lymphatic glands*.

Contagious
character.

In opposition to many contrary assertions, the *contagious character* of phthisis must decidedly be asserted. I find it impossible to refute a great number of observations referring to strong men who have never been ill or in feeble conditions of health, and who have been infected by their sick wives. The softened expectoration of the last few weeks of life seems to me especially to be dreaded, whilst I can attribute no infecting power to perspirations or even to the use of the same bed-linen. Nor can I ascertain a close analogy in the nature of the affections. The question of contagion is of no inconsiderable value in answering another question, namely, whether it is advisable to gather together sick persons of this kind at health-resorts or even in hospitals. Were I to let experience alone speak, I should have no scruple to express on the matter, especially as the advantages of such intercourse together are not to be undervalued in a mental as well as a physical respect; theoretically, however, there are of course many things to be advanced against it. The real vitiation of air arising from the exhalations of the sick persons must always be confessed; and the inference may be drawn from this that a collection of several sick persons in one apartment, especially in the softening stage, is not admissible. Unventilated apartments for inhalation of vapours with supposed curative qualities must for this reason be especially proscribed; apart from the fact that a room not capable of ventilation is always a terrible thing in diseases of the organs of respiration. However, for the infection to become perfect, a disposition seems to be required, possibly a local disturbance of the nutrition and functions of the lungs in Körner's sense.¹ Several cases of contagion are mentioned in the immune valley of Jauja in Peru, and contagion is therefore not affected by climate.

¹ See *Allgem Wiener Mediz. Zeitung*, 1871, No. 24 et seq.

[The editor believes that he has seen rare instances of the communication of phthisis by the sputa and exhalations in the way alluded to by Rohden; but he has seen much more frequently what he cannot help regarding as communication from the diseased husband to the healthy wife; and in all these instances the disease ran a short course in the infected wives, while, on the contrary, the husband's affections were very chronic and almost latent for a long period of time.]

The agreement at present existing among *anatomists* Anatomy.
with regard to phthisis, may be reduced, as we have already mentioned, to the assumption of two principal classes of conditions which are found in the body after phthisis. One of these is composed of various forms of parenchymatous and superficial inflammation; the nature of the other seems to consist in the occurrence of a distinct form of tumour. Various affections constituting the first class are even now undoubtedly, in their early stage, recognised as proceeding from a phthysical disposition and as connected with it; others seem only in their further progress to undergo deleterious phthysical changes. The origin, however, of that form of tumour, the tubercle, is, as it seems, independent, arising from infection. If the inflammatory forms do not prove fatal within a short time after their appearance, owing to the great extent of the local affection or to a specially slight ability for reparation on the part of the individual, various chronic conditions occur, during which life may, it is true, hold out more or less long, though always on a low stage of health—degenerations of various kinds, among which especially the new formation of connective tissue, cirrhosis, plays an important part. How far the supervention of genuine tubercles modifies the matter, has become very questionable in spite of F. Niemeyer.

Almost all these forms exhibit themselves in certain *physiological phenomena*, which we must consider more Physiology.
attentively. While we undertake to sketch them, we are almost frightened from the undertaking by the difficulties standing in our way, the least of which lies in the lack of

adequate treatises on the subject. All that exists on the matter proceeds from old ground; the little that is new has still for the most part scarcely the value of fact, and the greater part is mere hypothesis. Nevertheless, there are many things with which we cannot dispense as a basis for subsequent sections; whenever we venture on the field of hypothesis, it will be marked by the expression of uncertainty, even although these hypotheses are not advanced without being based on clinical observation.

Cough
and ex-
pectora-
tion.

1. The simplest and most constant symptoms of phthisis are *cough* and *expectoration*. The former is caused by an irritation which if at the larynx, and at the point of bifurcation, may be very slight in order to give rise to coughing; it must be somewhat stronger in the bronchial tubes; and the alveoli have not yet been investigated. Whether cough can proceed from irritation of the roots of nerves, is questionable (Nothnagel). Probably, therefore, every cough is occasioned by an irritation of the ends of the nerves in the mucous membrane of the lungs.

On the whole, however, the frequency and strength of attacks of coughing and of each separate cough, depend on individual circumstances. Nervous and sanguine natures react upon the slightest irritation with great and violent coughing; and especially sick persons who are otherwise strong, and who have always subjected their body to rough treatment, have incredible coughing powers. These furious coughers are generally in a short time hoarse from diffuse catarrhal swelling of the mucous membrane of the larynx. On the other hand, quiet persons, and those whose reaction is slower, may have reached a point of great pulmonary mischief, without any attacks of cough having occurred. On closer inquiry, they confess to a frequent clearing of the throat at these times. In these natures, the motor powers of the bronchial tubes carry the sputum so high that it is discharged by simple, though rather vehement expiration.

The barking and often screaming sound of the *cough* of *hysterical girls*, rendering it audible even at a great distance, proceeds, it seems, from excessive reflex irritability of the nerves of the mucous membrane of the lungs.

The impossibility of drawing a deep breath without coughing, pointed out to me in every case that the simple irritation produced by the quantity of air rushing into the lungs with rapid breathing could not be borne. Physical influences are here of importance. The so-called *dry cough* is distinguished from the loose one only by consistency, and the consequently difficult or easy ejection of the sputum. Hence the dry cough is also a sign of the commencement of secretion rich in cells, deficient in fluids. When softening takes place, the sputum becomes more fluid, and hence easier to discharge. After softening and discharge, the cough again becomes dry, and resultless until the distribution of the blood has been restored, after which it may entirely disappear. Slight hard secretion seems to irritate as greatly as plentiful fluid secretion, and this perhaps explains the expectorant effect of lukewarm drink. The dryness or dampness of the surrounding atmosphere is in direct proportion to the dry or soft cough. In the former case, i.e. in dryness, the water of the lungs evaporates plentifully, and the secretion becomes consequently drier; in the second case, not only is the reverse the case, but the slight evaporation from the skin furnishes water also for the moisture of the lungs. Heymann (Wiesbaden) explains the increased irritation of a cough in a dry air, and its diminution in a moist one, directly by the diminished or increased moisture of the nerves of the respiratory mucous membrane. If the irritation to cough be repressed for a time, the effect is afterwards all the more energetic and successful, as the irritation caused by the increased secretion is all the stronger; hence the expectoration is greater in the morning after sleep. Another irritation producing cough consists in the rapid *change of temperature* in the air to be inhaled; hence wind is an annoyance when it blows with different degrees of temperature, or with chilling boisterousness and dryness.

Coughing, as such, has the direct consequence which arises from any violent action upon the circulation; that is, it leaves behind greater or less exhaustion, which manifests itself in many cases in a painful state of the muscles of the thorax. Pains in the diaphragm are of very common

occurrences. It is, moreover, not to be disputed that dry pleuritis is sometimes produced by coughing, occasionally owing to the mechanical tearing of existing adhesions; pneumothorax from rupture in the lungs scarcely ever arises otherwise than from violent coughing. Lastly, from the nervous coughing of hysterical individuals, as soon as it appears continuous and intense enough, changes in the state of the mucous membrane of the lungs and ruptures of bronchial arteries of various calibre can occur, without necessitating a thoroughly bad prognosis. The symptom of more violent coughing after eating, especially after certain food, differing according to the nature of the individual, proceeds without doubt from a reflex action through the pneumogastric nerve. The occurrence of vomiting in violent coughing, is empirically to be traced to the presence of hard or purulent sputum in the pharynx, which excites nausea and tickling, unless the above-mentioned presence of an irritation in the hyperæsthetic vagus in itself occasion vomiting with coughing. Possibly this explanation may apply to the cough-quieting effect of certain warm drinks and of whey. Withdrawal of blood, as in hemorrhage, frequently entirely removes the irritation.

Sputa.
Hemoptysis.

A detailed description of sputa is out of place here, and scarcely anyone can understand it from mere description. Bloody sputa, which do not come from the varicose veins of the pharynx, may be divided into those which proceed from the bronchial mucous membrane, light red, mixed with froth, for the most part discharged without real coughing, by clearing the throat; those which proceed from ulcerating cavities (yellow, red, or brown cavernous sputa); and lastly, bleedings from branches of the pulmonary artery (for the most part copious and rapidly fatal). Bloody sputa have a limited influence on the diagnosis, and scarcely any influence at all on the prognosis. Some produce even a decidedly easing and beneficial effect, and afford valuable indications for treatment. In many sick persons the psychological effect of the bleeding assumes a foremost place, but in some highly disposed persons an aggravation is caused by inflammatory reaction of the pulmonary mucous membrane from the

blood left behind. An indication is thus afforded that the treatment which keeps the sick person as motionless as possible, is not always advantageous.

2. *Fever*.—Generally speaking, the heat accompanying phthisis is that which accompanies inflammatory diseases, with sometimes moderate, sometimes high pyrexia, but it is without any specific peculiarities. Subsiding phthisical affections, cavities surrounded with connective tissue, are free from fever. From the inflammatory fever attending the commencement of phthisical affections, we must distinguish that which accompanies the softening, discharge, and demarcation of the cheesy deposits left behind, and of the degenerated parenchyma; when this discharge, or the demarcation, is accomplished, the fever abates frequently very quickly. The thermic distinctions between acute tuberculosis and disseminated chronic pneumonia are doubtful. No distinct connection exists, generally speaking, between heat and local change. Nothing but the individual ‘pyrogenous’ tendency of the sick person exercises any influence on the amount of heat, and this influence is often greater than that of the form, the locality of the development, and the progress of the disease. *The amount of fever in individual cases can be allowed but a very limited influence upon the prognosis*; with suitable treatment, many constitutions bear even very considerable degrees of temperature for a long time without experiencing any decrease of weight and diminution of the nutritive functions; others are affected disadvantageously by a comparatively slight increase of temperature. Age and sex appear, at any rate after youth, to exercise no constant influence on the degree of the heat and on the height of the fever. It would be highly important if Lebert’s view were confirmed, that in the long duration of fever it was its constant variations that exhausted the body. Another of Lebert’s statements I agree with from manifold experience; namely, that a withdrawal of blood or excessive bleeding of the lungs may check or weaken the progress, and may even cause a complete reduction, of fever. This experience ought to decide the question as to the diet of feverish phthisical

patients in favour of a preponderance of vegetable food—fat and fat—producers, in case climate and important considerations do not compel the contrary.

If it be asked what assistance these various statements, almost all of which in no wise correspond with former assumptions, afford in deciding the question as to what treatment should, *generally speaking*, be given to phthical fever, the answer may be gathered from deductions to be drawn from the following, and for the present uncontrovertible, *definition of the fever*. From the seats of the inflammatory changes, substances are admitted into the blood which paralyse the moderating parts of the brain, and thus allow the activity of the spinal centres to increase unimpeded, allowing an abnormal increase of change of substance, and thus of the formation of heat, while the body regulates its functions accordingly. It is thus intelligible how an irritation, which may be conveyed to the medulla from any point, moderates the symptoms of fever, and influences the frequency of the pulse directly, and the temperature indirectly, by the restitution of the influence of the medulla upon the spinal centres. On the other hand, the effect of sedative treatment, of warm baths, of damp and warm atmosphere, and of the prevention of all excitement and disturbance, may be achieved by direct quieting of the irritated spinal centres. In cases of phthisis, a protest must be raised against the modern want of moderation in therapeutic treatment. There is also a great onesidedness in regarding the symptom most apparent in the physical instrument as being the exclusive point of attack, and in believing that, when this point of attack is weakened, a grand step is obtained. Fever-heat is not merely increase of temperature, but an increase of temperature arising from special causes; and as these causes lie, we believe, nowhere else than in the nervous system, the treatment is without doubt more rational when directed to this, and when its condition is regarded as determining the amount of injury. The more readily the nervous system answers by reaction, the slighter should be the attack, and the more forbearing the treatment on the whole, in order that the system may not be too early

depressed, and the more attention must be paid to the maintenance of the physical energy by regulating the reception and expenditure of air and nutrition. For sick persons of this kind, repose and equability are the main conditions in the choice of a health-resort; they afford in general a more unfavourable prognosis than vigorous natures. Considerations of a similar kind gave rise to the old assumption of *erethic and torpid constitutions*, and of *erethic and torpid phthisis*. We shall presently see how far these terms have caused confusions and errors of another kind.

Lastly, the more sudden and intense the therapeutic treatment, the more rapid and the greater is its effect. The stronger the doses of medicine, the colder the water, the higher the fall of the douche, the greater is the effect.

3. *Perspirations*.—From the experiments of Pettenkofer and Voit, we may regard genuine hectic perspirations as the effort of the heated body to cool itself, just as we see this effort in healthy persons during the night succeeding laborious physical work. The perspiration to be observed in advanced phthisical conditions may be regarded, however, as a vicarious action to supply the deficient secretion of urine in consequence of stagnation in the kidneys; and this assumption is supported by the result of diuretics of a certain kind in counteracting the perspirations, and by the fact that under the influence of moist air, which experience has proved as causing increased diuresis, many cases of phthisical perspirations have rapidly subsided. The perspirations do not seem weakening in themselves. The lassitude attributed to them is synchronous with the breaking out of the perspiration, which may be considered as lysis of the preceding feverish condition. The symptom has, however, a practical importance not to be undervalued, both from its unavoidable disturbance of the nightly rest and from the traditional dread of the ‘exhausting’ perspiration. Peculiar typical perspirations of various durations have been described by Bettelheim,¹ and have been explained as feverish attacks which might

Perspirations.

¹ *Arch. für Klin. Med.* x. 4, 5.

appear with an existing disposition to phthisis, and, indeed, also in other forms.

Emacia-
tion.

4. *Emaciation*.—This is not only dependent on the increase of the change of substance from fever, for otherwise all feverish phthisical attacks would produce emaciation, and this is not at all the case. With most sick persons the origin of their emaciation is complicated, and is often to be traced to influences which are apparently remote. Generally speaking, we may say that a phthisical person is the less inclined to become emaciated, the better his digestion was formerly, and the less those stimulants are withdrawn from his digestive organs to which they have been accustomed, and the less, lastly, that the sick person is excluded from the benefit of free air and exercise. The necessity to the mucous membrane of the stomach of certain stimulants is shown among others by the investigations of Manassëin, who ascertained in pyrexia—in dogs, it is true—not a want of pepsine, but a want of acid in the gastric juice. Hectic emaciation is, above all, a diminution of the fat by which, according to Voit's investigations, the albumen is husbanded. Upon this principle the fact is based, that supplies of fat and of fat-forming substances ever and justly enjoyed great reputation in the treatment of the affection in question. At the beginning of the malady, it may naturally often be difficult to distinguish the emaciation caused by morbid conditions disposing to consumption from that produced by the phthisis itself; this difficulty must, however, be solved, if possible, in order to combat as well the *indicatio causalis* as the *indicatio symptomatica*. An excessive degree of emaciation, though not arising from fever, appears in extensive destructions, which are cured, and which, with the exception of shortness of breath, do not cause any pulmonary symptoms. These are, perhaps, identical with those observed in emphysema, and like them they may be explained by stagnation in the vena cava ascendens in consequence of the decay of numerous capillaries of the lungs. In the same manner by the impeded discharge of the lymph and chyle into the subclavian vein, the nutrition of the blood and of the whole

organism must be interfered with, just as the insufficient supply of oxygen necessitates a deficient oxidation of the food introduced. The cachectic appearance of these persons, the dry, pale skin, with the nutrition but rarely and temporarily restored, can scarcely be otherwise explained, than by these complicated circumstances; circumstances worthy, however, of the utmost attention of the physician, both on account of prognosis and of treatment.

5. *Shortness of Breath* is a symptom occurring more or less in all phthisical persons, from the rapid getting out of breath peculiar to a phthisical disposition or to the beginning of phthisis, which proceeds from the insufficient quantity of blood-corpuscles, together with a disproportion between muscular action and power, to the excessive dyspnœa of extensive and old destruction of substance with or without vicarious vesicular emphysema. The latter is inevitable when the malady is of years' standing. The dyspnœa of fever is well known: increased change of substance produces more carbonic acid, and the more carbonic acid the more respirations. The dyspnœa arising from insufficiency of the lungs in excessive cirrhosis or loss of substance, may become of very great extent when the supply of food is too plentiful, or the sudden increase of the absolute amount of water in the atmosphere reduces the giving off of water from the skin and the mucous membrane of the lungs to an unsufficient minimum. This condition becomes serious when not remedied by great revulsion, or by energetic venesection, and œdema of the lungs may establish itself past recovery; then and there hemorrhage of the lungs sets in, and this produces an alleviating effect.

Shortness
of breath.

CHAPTER II.

TYPICAL CASES OF CHRONIC PULMONARY CONSUMPTION.

I HAVE already explained the reasons why we must desist from laying down definite and histologically based forms of disease. The practitioner must distinguish three more or less accurately recognisable conditions of the lungs: namely, catarrh, condensation, and destruction. If he be aware *that one of these conditions may proceed from another, and that all three may appear together in manifold forms*, he will not only, from their small number, obtain a clear range of view, but also a satisfactory guide for therapeutic treatment, when he has taken into consideration all 'attendant circumstances.' For simple practical reasons I shall first discuss the symptoms of chronic disposition to phthisis, the treatment of which is wont to prove a great blessing in those circles where, in addition to external requirements, there is enough discretion to submit to measures of a far-sighted character.

Phthisical
disposi-
tion.

The *phthisical disposition* in young persons shows itself especially in weakness, owing to feebleness of the most important organs. The strength of the action of the heart is generally below the standard, owing to weakness of the muscles of the heart and the deficient function of the medulla (hence also a rapid pulse). The consequences as regards the outward appearance are coldness and paleness of the skin, indicating a bad state of nutrition and deficient activity in the organ (the skin); the consequences as regards the digestion are variable appetite, inclination to fluid evacuations, and weakness of the assimilative organs. The nervous system discharges its office variously, according to the individual; sometimes responding violently and promptly to the smallest irritation, and sometimes indolently and apathetically yielding to

passive resistance. If with these peculiarities be combined a narrow thorax or any defective mechanism of the respiration whatever, there ought to be no delay in removing the sick person from his former relations, into a position in which the following essential points may be obtained: improvement of the nutrition without great co-operation on the part of the organism, increased action of the lungs, and greater activity of the organ of the skin. Frequently a residence for some months in the country is sufficient, if possible on wooded hills, with a plentiful diet of milk, butter, and bread; a more powerful effect is produced by removal to mountain-districts, the height of which must be carefully considered, according to the acclimatisation difficulties of the stranger, and, when possible, by a long sea-voyage in a well-arranged vessel. For the more rapid recovery of regular circulation and good digestion, baths and douches may be recommended and are frequently indispensable, according to the capability of reaction; and lastly, carefully arranged gymnastics of the whole body, special attention being directed to the thorax and its contents. As regards wintering in a mild climate, I am in favour of it only in cases requiring the most delicate management; if the summer have been properly used, it is advantageous not to deprive the sick person of the beneficial effect of dry cold, and by good exercise in the open air day by day to retain his capability of enduring the changeful weather of our average winter, and especially of the spring. In acute disposition to phthisis after severe diseases, as well as in dispositions arising from conditions of weakness resulting from a bad mode of life, the *indicatio causalis* must of course be strictly taken into account. In prescribing a course of treatment in scrofulous cases, to counteract the general weakness, good sool-waters taken internally may turn the scale; and in chlorosis, stimulating baths and iron-waters. Hüter proposes that scrofulous glands should be prophylactically removed with the knife. Of those affections, the convalescent state of which incurs the danger of phthisis, pleuritis must especially be mentioned. Pleuritic exudations are extremely dangerous, and it is urgently enjoined

to accelerate the complete absorption of the exudation in order not to allow the catarrh of the other lung to increase into phthisis. Health-resorts with a moist atmosphere seem in these cases to deserve the preference—whether from the promotion of diuresis which is always observable in damp atmospheres, is a question. Lippspringe and Soden often quickly effect the absorption of recent exudations; whilst older exudations, which have already caused a state of weakness, especially of the spinal marrow, do better with the stimulating gaseous thermal baths or mountain-air.

I. CATARRH (BRONCHITIS AND PERIBRONCHITIS).

Simple
catarrh.

a. *Simple Catarrh*, only leading to phthisis under unfavourable circumstances. The representatives of this class are well-to-do individuals with too much food and too little exercise. The venous system is for the most part strongly developed, and respiration is in many cases impeded by corpulence, especially of the abdomen. Frequently quite young people fall under this head; for instance, merchants with good digestive organs and great counting-house work. It is frequently seen in weakly childhood, when, from mistaken care, the child is too much indulged, and too much fed with meat, but little sent into the air for fear of cold, and restrained from all physical exercise for fear of over-fatigue. Subsequently a fulness of blood is developed, which at first claims the attention of the physician in the pharynx and larynx, and afterwards may produce hemorrhoidal bleedings, but which in the main tends to originate and keep up catarrhs from congestion of the respiratory mucous membrane. The sputum, rich in mucin, poor in cellular elements, is now and then mixed with blood not only from the pharynx, but from the bronchial membrane. Profuse bleedings rarely occur, but in the greater number of cases they may be regarded as good and disencumbering. Examination finds no difference of sound to any great amount, and the stethoscope generally only proves the existence of slight catarrh of the trachea and larger

bronchial tubes. It is only in cases of fresh recrudescence that an affection of the finer tubes is to be perceived. All treatment remains ineffectual unless the *indicatio causalis* be attended to. *Moderate mode of life with plenty of physical exercise, increased activity of all the organs of secretion and excretion, and direct diminution of the quantity of blood* by bleedings and saline aperients, are the simple points to which the beautiful and admired results of many a course of medicinal waters may be traced. Older persons suffering in this way may be sent to Kissingen, Homburg, Marienbad, and Carlsbad, and very young persons may be sent to some mountain-resort for whey or decoctions of herbs, and in the autumn for a grape-cure to the Rhine or the Palatinate, and lastly to any good spa that may be preferred, and which offers good bath-arrangements and mildly aperient mineral water, and the impossibility of gastronomical excesses. Cold-water establishments, with their packings, baths, and sour milk, are also effectual. In his home, the sick person for the most part lacks perseverance and confidence in carrying out the methods in question, attention to which, in total contradiction to his former life, while it is not only rendered endurable to him by the society he meets with at the spa, seems to him even an achievement all the more estimable, the more repugnant the treatment was to him at the first.

b. *Genuine Phthisical Apex-Catarrh* arises but rarely from *simple catarrh*. It attacks persons of chronic disposition, and is developed by long-continued injurious influences, which render the respiration imperfect, and especially permit the upper portions of the lungs to remain in action and unventilated. After some months' duration, which now and then witness remissions of the catarrh, the parenchyma of the lungs takes an evident share in the disease by means of peribronchitic processes, and change in the percussion-sound is then heard, and the respiratory murmur is rougher. A cure can in this case only be effected by loss of substance, with dilatation of bronchial tubes and partial emphysema, or with contraction of the diseased apex and flattening of the

Phthisical
Catarrh.

corresponding part of the thorax. Fever and perspiration are symptoms of this encroachment on the parenchyma. They subside, however, and cease when the inflammatory stage of the peribronchitis ceases. This, however, only occurs when the sick person is speedily brought into a better condition, which not only removes the debility, but also encourages the greater activity of other parts of the lungs. These are the cases which furnish strikingly favourable results, if the methodical action of the lungs (pulmonary gymnastics) be strictly maintained. Simple deep inspirations, with a long pause before the equally deep expiration, are sufficient in most cases; in others the existence of great irritability requires the aid of soft air containing aqueous vapour (inhalation machines and inhalation apartments). A third class, lastly, finds the best remedy in methodical mountain-climbing and rough treatment. To the latter belong most of the cases of spontaneous cure, such as we see among people of the lower classes (after having acquired the malady in the winter) during the summer, which imposes on them severe labour in the open air. All sick persons of this kind grow worse from sedentary life and deficient exercise. Even a long state of quiescence is often followed by new progress of the affection, when the well-spent summer and autumn are succeeded by a winter from the atmospheric influence of which the sick person imagines he must guard himself by keeping his room. In this case, the relapse is rarely delayed till the new year. Worse in its prognostics than the first attack, inasmuch as it starts with the residuum of this, it often ends fatally in the spring, if this do not appear early enough to release the sick person from the fatal confinement to his room. The prognosis of the case is regulated by the strength of the sick person and his external circumstances. If a certain amount of soundness of organism be combined with favourable pecuniary circumstances, if the sick person can for a long period withdraw from the circumstances that affect his health, a wonderful recovery may be effected, attributed generally to the last-visited health-resort, because this has completed the recovery. If there

be only catarrh without fever, a prolonged holiday is sufficient, provided the place be chosen with reference to the *indicatio causalis* and the individual constitution. If peribronchitis have set in, we can only advise waiting, keeping aloof from injurious influences, and sustaining the strength. In the whole treatment of phthisis, there is no more grateful, but also no more intricate task presented to the physician, than the treatment of a case of inflammatory apex-phthisis. In no other case is it so distinctly apparent to me how much the good termination of acute or subacute affections is connected with the restoration of each physical function, however slightly disturbed, and with the excellence of an uniform arrangement of the daily conditions of life. No other affection, therefore, requires so thoroughly the removal of the patient under certain influences, and his superintendence by a physician well acquainted with this branch of practice. Upon this principally depend the advantageous results afforded by good establishments of this kind, such as *Görsbendorf* and the *consumption hospitals* on the south coast of England; whilst at bathing-resorts many a hopeful result is endangered by the want of supervision of the invalid's life in hotels and lodgings. Medical establishments at suitable bathing and health-resorts are desiderata, which would result in a diminution of mortality from phthisis not yet obtained. The predominance of any peculiarity regulates the choice of the spa also in feverish cases, though inflammatory cases with fever always should have places with equable atmospheric conditions, where only slight demands are made on the nervous system. In summer, therefore, quiet, warm, and moist places should be selected, such as *Lippspringe* (especially when the digestion is disturbed and great irritability exists); *Soden* (where there is no occasion to fear the carbonic acid), and many other suitably situated and well-arranged health-resorts; in winter, localities characterised by uniformity of temperature. If the local process be relatively cured, the sick person may be sent to the sea or into the mountains, in order to establish what has been gained, and in order to keep the invalid, who imagines himself recovered, aloof

from the injurious influences of his home. This is the sole reason why such stationary invalids are sent to climatic places of resort, which are somewhat above the average temperature, and possess more agreeable weather than the home, or only a different one. The sick person is there exposed to the fresh air, which he is not at home. He strolls about there, while at home he works or sits in the stifling atmosphere of the ale-house or wine-tavern. In the mountains he makes long expeditions in sledges and snow-shoes, while at home he sits in slippers by the side of his stove.

Extensive
catarrhus
phthisis

c. *Diffuse and disseminated Catarrhal Phthisis*, in otherwise robust persons, as a disease arising from the inhalation of dust, is an affection which shows a greater tendency to improvement than the forms arising from constitutional debility, if the sick person be kept aloof from the injurious influences of his trade and exposed to pure air. Extensive pleuritic adhesions from wounds or other causes may mechanically injure the lung-tissue. As the injury which causes the evil does not diminish, the best thing in these cases is to establish as healthful a régime as possible, and at the same time to give a guarded prognosis. Lastly I may add a kind of diffuse chronic bronchial affection in *highly disposed persons*, which frequently, after a pause of years, suddenly appears as peribronchitis purulenta, and this with the symptoms stated by Buhl.¹ Constant fever, frequently attended with cold shivering, purulent sputa, for the most part with an absence of epithelia, but with early perceptible elastic fibres, and the rapid and extensive destruction of tissue, characterise this affection, which in most cases defies all treatment.

Possibly, among the cases mentioned, that of *genuine tuberculosis* has been missed. Acute tuberculosis is, of course, no subject for this work; chronic tuberculosis—only to be distinguished from the other by the slighter diffusion of the eruptions—is *intra vitam* not to be separated from the other forms of disease, and therefore, at the

¹ *Lungenentzündung*, &c., 1872.

present stage of our science, it requires no essential alteration in the treatment just given.

II. PNEUMONIC PROCESSES—CONDENSATIONS.

These are only to be ascertained with certainty when they exist to any great extent, or at any rate reach the surface of the lungs. The most numerous cases of this class, those of *lobular pneumonia*, are frequently only recognised after a more or less protracted existence of general symptoms, and among these cough may be altogether absent. Chronic pneumonia of the upper lobes is characterised by only slight or wanting movement of the upper ribs, intense dulness, and the speedy appearance of clotted sputa sinking in water, and frequently mixed with blood, signs of parenchymatous destruction. The issue seems to be different according to the seat of the affection in the real framework of the lungs (Buhl's desquamative pneumonia), or in the mucous membrane (catarrhal pneumonia); at any rate, cases apparently identical at first differ subsequently: in one class, the part of the lung affected shrivels up and diminishes in volume, in another, cavities are formed and the loss of substance is circumscribed. Pneumonia occurs with considerable derangement of the general health (its confusion with gastric fever is very common), and the disease is especially severe when the whole lobe is affected. This affection is not often subjected to treatment at bathing and climatic resorts. Violent fever and other symptoms of severe illness render a change of residence at first hazardous. If the patient recover a little, and the fever cease, extensive cavities or deformities of the thorax and an altered position of the intestines, in consequence of considerable contraction, may be found. These sick persons require the greatest care. Every measure must be considered with the most intense attention. A mode of treatment, as indifferent as possible, may for the most part be advisable, in order to prevent overwhelming hemorrhage from the not yet obliterated branches of the pulmonary artery, and to avoid every cause for a fresh increase of inflammation. A very bad prognosis is afforded

Pneumonia.

by the cases of chronic pneumonia which have arisen in childbed, and which are unfortunately frequently the objects of balneotherapeutic treatment. Slighter cases of pneumonia, especially apex-pneumonia, allow bolder attacks against constitutional anomalies and the local condition itself. A speedy removal of the cheesy product of inflammation—the presence of which is in itself a danger on account of possible absorption—may, with regard to the general health, in many cases be the first object, and may be attainable in a few months. The equably moist and not too warm health-resorts afford the best chance under the circumstances, with the addition of accurately measured quantities of alkaline mineral waters; moreover, the presence of calcareous salts seems to be useful by promoting cicatrisation. A plentiful supply of food is advisable only in a few instances, as in these cases of pneumonia, especially in the softening stage, there is a striking inclination to the diarrhoea of indigestion, which by long continuance produces infiltration of the mesenteric glands and phthisis of the intestines, and also creates a tendency to fresh inflammation and troublesome bleeding. Lastly, the inclination of the glands of the laryngeal mucous membrane to become cheesy and ulcerated, is a condition which must influence the choice of the place and of the physician. Too great activity of local treatment is urgently to be advised against; the strictest repose of the diseased local organ and gently astringent inhalations are frequently sufficient. The commencement of an *affection of the bowels* is in itself no contra-indication against the trial of a health-resort, and frequently a strong dose of castor-oil, and subsequent change of diet, may succeed in checking the tendency to diarrhoea. On the whole, this tendency seems to be greater in health resorts with a moist atmosphere than in others; the notorious *mal de Madère* is well known as constantly fatal to the sick there, whose rapid removal from the relaxing climate is rendered impossible by circumstances, while the Venetian diarrhoea of similar character is avoided by excursions to the Continent.

III. QUIESCENT CONDITIONS WITH DESTRUCTION OF TISSUE—
PERMANENT CONDITIONS.

These are constantly subjects of treatment, from the smallest to the most extensive. The sick person complains often only of an expectoration of mucus, which is left behind after a febrile affection that had occurred years before, and which varies in amount, for the removal of which he should be glad to do something, although he is not much annoyed by it. It is only when the anamnesis is accurately investigated, that it is possible to distinguish between cavities from ulceration and those from bronchial dilatation. The position on the surface of the lungs naturally favours the idea of a cavity from pneumonia, whilst a deep-seated position rather points to bronchial origin. The latter seems, according to my own experience, to be far more capable of resisting new injurious influences, and to promise a longer period of relative health, than the former, the subjects which I have frequently seen return with fresh attacks. The danger is greatest during the first two years after the occurrence of the loss of substance; fresh inflammation of the surrounding parts and bleeding from the vessels not yet obliterated are by no means rare. Fresh cavities seem also to infect occasionally other still healthy parts of the lungs through their secretions, whilst the secretion of old and hard cavities seems to be less dangerous. In rare cases, a cavity impedes nutrition by immense secretions of matter, and checks development in children, like a gigantic issue. Extensive destruction of the parenchyma, however, always cripples the organism, as it produces relative insufficiency of the lungs, relative in so far as it depends principally on the individual and on his external circumstances. Unlimited supply of open air; great moderation in food, which is not easily oxidised; constant attention to the organs of excretion, are necessary; but with careful management life may be prolonged considerably, and even rendered comfortable, in spite of most extensive loss of substance. On the other hand, neglect

Residuum.

of these rules constantly leads to a fatal result. No inconsiderable number of phthisical patients whom I had cured have subsequently died from hyperæmia of the lungs or from hemorrhages, through the endeavour to remove the unavoidable weakness resulting from their crippled condition, by a plentiful diet of meat and wine, for the suitable use of which they lacked open air, bodily exercise, and a healthy condition of skin. There are cases in which bold bleeding has the effect of saving life, and sparing diet invigorates the poor 'strength-needing' phthisical sufferer and assists his restoration. Careful whey-cures, by disburdening the patient and thereby aiding his recovery, have likewise an advantageous effect. I have also seen much good arise from a residence at the sea, when the sick person was reasonable enough to keep aloof from the usual gluttony of convalescents at seaside health-resorts. Cool summer climates are in general to be preferred for these patients; the heat, followed by great tension of vapour, at low-situated and damp places, is dangerous for them, as it represses perspiration, and produces pernicious consequences to the circulation in the lungs before the kidneys have been called into action. With respect to the use of warm or cold air and warm or cold water, the state of the heart and of the nerves of the heart must decide. Weakness of the heart contra-indicates warm baths, very warm air, and carbonic acid. The most adequate stimulants are short and cold douches, especially on the nape of the neck, wine, and oxygen. By far most cases of this kind not only can bear, but they even require, a certain amount of stimulant. These are the most successful cases of the climatic resorts of Italy and mountainous districts. From their increasing sense of health, they are soon accustomed to look upon their still remaining cough and expectoration as an endurable *misère*, which, moreover, abates the longer the patient yields to an easy life of idleness in the free air and in the beautiful country.

General
points of
view.

If we now cast a retrospective glance at the therapeutic considerations which have been attached to the forms of disease we have been discussing, we shall not fail to

perceive that there are two principal points of view to which the physician must mainly adhere in order to be guided in his treatment in the individual case, namely, *the phase of the disease and the constitution of the sick person.*

In each case we must ask ourselves—

1. Whether we have before us a condition of illness, which allows us to perceive from the history of the recent period, and from the *status præsens*, that the malady is still increasing—is the phthisis still active? Or—

2. Does the local condition, combined with the anamnesis, prove only an abnormal state, the residuum of active phthisis, joined with a certain decrepitude, principally requiring our care? Is the phthisis stationary? In each of these two cases we may inquire again—

a. Does the patient belong to a weakly, excitable class of constitution, characterised by excessive reaction, or—

b. Is he of a vigorous, more heavy constitution, with less violent reaction?

In both classes there are found types of weak and strong constitutions, the former most evident and numerous, of course, in the class of active phthisis, in the prolonged duration of which even the strong (formerly ‘torpid’) constitution becomes weakly (‘erethic’). The cases of still *active phthisis* may be treated as illnesses in the true sense of the word, and indeed as illnesses accompanied with inflammation, the limitation of which must be the first object of treatment. We do not know how far the affection may extend if we fail in limiting it. It must, therefore, be our aim, in the second place, to maintain the strength of the sick person as far as possible. In saying this, we have already said all that is necessary to the judicious physician. These sick persons must have physical and mental repose, and a uniformity of all surrounding influences. The equable, moist, warm, and quiet health-resorts are suitable for them. Quite otherwise is the treatment of the chronic phthisical sufferer. In

recent cases he is a convalescent, and long remains an invalid. He must at first with caution, and subsequently with boldness, remain in the open air. He must afterwards take plenty of exercise, and must so increase and facilitate his change of substance that he not only repairs what is lost, but by the vigour gained may ward off fresh attacks. For him, health-resorts affording a certain amount of stimulation are almost necessary; he is chiefly of the 'torpid' class of constitution, to which the Riviera and the elevated regions are adapted.

Prognosis. — We further have seen, in discussing these current types, that the prognosis of phthisis need not be thoroughly bad; for, although the not utterly unfavourable opinion drawn from our own experience and from that of others is only gained from persons who have taken more or less effectual steps against this malady, on the other hand, such a number of cases of extensive and stationary destruction of the lungs come under our observation, that we do not see why a still greater number of cures should not be effected by means of skill than nature has often achieved, in spite of the utmost neglect as to the mode of life. Large empyemas are borne for years; very extensive hepatisation of the lungs often subsides; the prognosis of gunshot wounds of the lungs, without splinters of bone, is not bad; and yet most physicians still relinquish hope as soon as 'phthisis' is diagnosed, and have recourse to pure symptomatic treatment. Under this routine method, it is true, a phthisical patient rarely remains many years alive. Equally little, however, is a satisfactory result obtained when circumstances allow the patient only brief attention to his malady. An improvement may appear, but it is destroyed again by the circumstances that have originally produced the illness; and thus it is unfortunately with most. On an average, we may assert that a strictly regulated mode of life, only if maintained for *years*, may cure a case of developed phthisis, and may prevent a speedy return. For there is just as little any internal specific against ulcers in the lungs as against other ulcers; and, besides the treatment directly aiming at the cure of the local

lung-disease, there is nothing but the invigoration and alteration of the entire organism which is able locally to limit the evil and to repair the general anomalies caused by it, as well as those which ever arise anew. With respect to this we may say that phthisis is, amongst the dangerous chronic diseases, one of the more frequently curable. But 'it is the individualising art alone, unfettered by rules, which is capable of such a task.' Lastly, we must also assert that in no chronic disease is the prognosis so often deceived as in phthisis. The smallest loss of substance and the most locally limited catarrhs are frequently, after the pause of years, the sources of rapid and fatal derangements, perhaps in most cases from the development of genuine tuberculosis; while other patients, in spite of enormous local disease and great general exhaustion, hold out for years, and are ultimately cured without our being able to give even a tolerably satisfactory explanation. It is, indeed, a matter of pure conjecture to decide whether, and how rapidly, and how severely, the existing catarrh may produce ravages or not. A bad day, an overlooked circumstance, may overturn the whole prognosis. This ought to be all the more guarded, the more chronic the disease. He only who has attentively observed his patient for a long time, and has made himself acquainted with all his peculiarities, both somatic and psychical, can give any opinion of value as to the effect of a certain health-resort on the patient. It is not for the consulting physician to give unalterable advice for long periods of time, as incidental circumstances are not unfrequent, and these may render a change perfectly necessary. It is important that the local physician should be entrusted with unlimited authority during the residence at the spa or climatic health-resort. On the whole, it may be said that the strict and prolonged superintendence at establishments under medical direction holds out a better promise, than the residence of the patient in his own family or in private dwelling-houses. The sole conclusion which may be drawn from the results of the most different places and climates in cases of consumption, is that, *in the cure of phthisical affections, it is not the place,*

nor the climate, nor the mineral water that plays the principal part, but the mode of treatment. A mode of treatment thus responsible can, however, only be accurately carried out in establishments built and arranged for the purpose. It is only with regard to persons thus under control, that a prognosis can with any certainty be expressed. It cannot be so with regard to those left to their own devices at spas and health-resorts. The well-known and dangerous indiscretion of pulmonary patients leads almost all on every opportunity into transgressions, which in no affection are less tardy in their revenge than in phthisis.

CHAPTER III.

GENERALLY APPLICABLE CONDITIONS OF CURE.

I. CLIMATOLOGY.

IF I premise the statement that *phthisis is everywhere curable*, and that only those places have the pre-eminence which afford a greater number of favourable conditions than others; if at the same time we bear in memory the statement made at the end of the last chapter, that it is chiefly *the mode of treatment carried out by the acting physician of the place*, which can effect improvement and recovery in individual cases, we shall then bring to bear on the following pages, containing the pharmacognosy of the affection in question, that understanding of the matter which I must claim for the critical manner in which the treatment of phthisis has to be carried out, if it is to come forth from the chaos which has hitherto encompassed it. From the above thesis, as from the similar one in our general introduction, that different diseases may be cured at the same spring and the same diseases at different springs, many an inference of deep importance may be drawn which I shall not mention as occasion offers, but shall here at once discuss *en bloc*.

The one point in which all the health-resorts adapted for phthisis coincide, is their property of being air-resorts. Very many bathing-resorts owe their results in phthisis only to this property, which frequently in any village produces salutary effects, unforeseen, and therefore regarded as wonderful. Although unbiassed observation cannot always, with Mac Cormac and Paul Niemeyer, trace the origin of phthisis solely to bad air and bad inhalation, we may yet unhesitatingly state that *unlimited*

supplies of good and pure air are infinitely more important than anything else for the recovery of phthisis, and are often indispensable. Air polluted by exhaled gases is more absolutely injurious than any other usual bad influence, because in the most favourable case it causes a certain condition of weakness, which manifests itself by a diminished power of resisting other injurious influences.

Morning
air.

Evening
air.
Night: air.

From the feeling of refreshment caused on leaving the close sleeping apartment, the idea has arisen of the special healthfulness of *morning air*, and from climates which are characterised by rapid cooling and fall of dew at sunset, is derived the fear of *evening air*: while the curious dread of *night air* is only rooted in the comfortable feeling of being securely and quietly shut in. *Quam parat inimicus ventos audire cubantem!* Any sick person, if protected by suitable precautions, may be unhesitatingly exposed to the air by night as well as by day. To this opinion the author feels himself indebted for many a successful result formerly not obtained.

Variations
in the in-
tensity of
meteoriza-
tion.

There are various conditions of the atmosphere which may here and there hide its beneficial influence, and may often even paralyse it. The effects thus produced on the body are, however, always only relative, and relate only to individual temperaments, and to a certain class of sick persons: so that, as we shall presently see, when speaking of 'official' climatic treatment, the same atmospheric influences may produce entirely opposite effects on two phthisical patients. If a certain gentle *fluctuation in the intensity of the meteorization* seems to be essential to the health of man as a varying stimulus, producing a reaction in the organism by the increase or diminution of its own activity, it may, nevertheless, be regarded as a fact that, as a rule, the danger for the sick person does not lie in the intensity of climatic influences, but in their fluctuation. The climate may be damp and cold, like Iceland: it may be very dry, as Sanaa (Sana) in Yemen: but if its extreme properties be unvarying, it will, as, for example, the former, be almost free from phthisis, and like the latter, it will be a famous sanatorium for sick men and beasts.

1. *Temperature of the Atmosphere.*¹

The heat of the atmosphere has absolutely no influence on the local phthisical progress; hence nothing but the constitution and the mode of life hitherto pursued by the sick person has to be taken into consideration in deciding whether a definite degree of heat is advantageous or disadvantageous to the patient in question. Much reduced persons, and those thus or by bad habits rendered weak, suffer in the *cold*, because their powers of reaction and regulation are weakened. Their discomfort and chilliness seem to have positively a bad effect, and to produce direct injury by fatiguing the nerves; more vigorous persons, on the other hand, respond to the effect of lower temperature by the feeling of freshness and invigoration, and by increased activity of digestion and assimilation. Great cold is only well endured by weak persons when the stillness of the air retards the loss of heat, so that the production can keep pace with the loss. The dry cold air of a clear winter day has a beneficial effect on most sick persons.² In North America, for some years, phthisical persons have been sent for the winter into the dry cold of the Hudson's Bay countries (and to Minnesota); and I owe to the verbal communication of Dr. H. Weber in London, the knowledge of two cases of confirmed phthisis in missionaries, who have now for years been sound and vigorous in Labrador. I myself allow my patients to go out in the open air in all temperatures, and I am extremely satisfied with the result produced in sharpening the appetite, and in procuring them restful nights. The increase of oxidation by external cold and plentiful supplies of oxygen, is therefore the explanation of the positive advantage of this treatment. In the vigorous power of compensation which is thus produced, so that soon even great transitions of temperature are endured without injury, there lies, lastly, yet another reason for the physician not only to advise the plentiful use of free air day by day, but also to warn against the

Low temperature.

¹ See p. 43.

² See the chapter on the elevated health-resorts (p. 571).

indiscriminate use of warm climates by sick persons who belong to a moderate or cold zone.

High temperature.

High degrees of heat, generally speaking, produce a more pernicious effect on sick persons than moderate and low degrees, because but few and scanty means stand at our disposal for supporting the sick person's weakened powers of compensation when exposed to the former. Ice is one of these few means, and hence it is a necessary requisite at summer health-resorts. Anyone who attentively observes his patients will perceive that in the middle of Europe they find themselves best, and that they thrive most rapidly at those periods of the summer in which dews and shorter days moderate the temperature and increase the moisture. The hot months of July and August, with their absolutely high temperature and occasional great fluctuations in the amount of water, are less favourable.¹

2. *Moisture of the Air.*²

In moist air, on account of the slighter evaporation of water, the loss of heat is diminished; therefore, also, the production of heat; the assimilation of carbo-hydrates produces fat, on account of less energetic combustion; the change of substance is, generally speaking, slower, and mental and physical indolence is the result. Apart from other considerations, therefore, moist air is indicated for the debilitated, and for all weak persons. The body at the same time contains more water, and the functions adapt themselves accordingly. The loss of water by breathing and perspiration is diminished; the superfluous water is removed principally by increased secretion of urine. Watery secretion from the intestines, and therefore the regulation of the bowels in cases of habitual obstruction, are assisted, and this is also to be kept in view in the diet. The amount of water in the air is regulated according to the temperature. In higher degrees of heat, the air can hold more water in solution than in lower; the drying power increases, therefore, with the temperature. If the

¹ See 2 (below).

² See the chapter on this subject in the first book (p. 37).

increase of heat occur suddenly, or if there be no other source that produces water in order to quench the thirst thus caused or increased in the atmosphere, the organism has a sense of water being withdrawn from it, and the air produces a feeling of dryness. This often occurs in our latitude, when, from weeks of sunshine, the local water-sources of the atmosphere are exhausted, and the water before absorbed is carried away by currents of air. The temperature rises, and with it the dryness, to a fearful height, and, from the insufficient supply of water to the organism, fatal affections frequently occur as an evidence of the want of water in the blood. On the other hand, a high summer temperature, with a sufficient amount of moisture, may cause an enormous quantity of water to evaporate in the atmosphere, so that the absolute amount of vapour in the air, evidenced by the change in the barometer, rises, even in our own latitudes, to eight lines high, whilst near the equator it may even amount on an average to ten lines and more. This exception seems to act injuriously. Diarrhœa of a very obstinate kind, and many other derangements of the digestive organs, are to be observed. Among the phthisical patients at Lippspringe, I was struck with the immediate coincidence of bleedings of the lungs as accompanying such abnormal conditions of the atmosphere; this is to be explained by the sudden increase of the mass of blood, against which the blood-vessels of the ulcerated parts of the lungs are not able to afford sufficient resistance.

That a similar effect produced by the damp warm atmosphere of the tropics on those not acclimatised, is confirmed by the medical authors of those countries. Strong supplies of carbo-hydrates, such as Europeans are accustomed to continue most unreasonably under these circumstances, produce symptoms of venosity, and an enlargement of the veins, which call for bleeding, and form one of the main causes of the origin of the deleterious subtropical liver affections.

The equable temperature of an atmosphere is principally dependent on its amount of water. The more moist an atmosphere is, i.e. the more vapour it contains, the

greater the resistance it opposes to the radiation of heat. Tyndall has, by his experiments, rendered this a matter of arithmetical proportion; whilst dry air absorbed none of the radiated heat, moist air absorbed from 17 to 20. In dry air the heat is almost solely produced by the rays of the sun; consequently the places subjected to these are characterised by hot sun, cold shade, and freezing nights. Pneumonia is therefore very frequent at Nice, Rome, and Montpellier. At Nice it forms ten per cent. of the illness prevalent. Moist air, on the contrary, is attended with warm nights, moderately warm noontide hours, less difference of temperature in the shade, and frequently the temperatures of the day and night are equally high; in moist warm countries, therefore, the tendency to catching cold is absolutely less than in dry ones.

3. *Atmospheric Pressure.*

This is constantly made use of in the explanation of physiological occurrences, and many writers on phthisis have been in this way led into the strangest extravagances. The experiments with the pneumatic apparatus deal with sudden variations which occur in the atmosphere only as great exceptions, and never at all with us. With regard to the influence which changes of atmospheric pressure directly cause by affecting the amount of gas in the blood, see the subsequent chapter on elevated health-resorts (p. 571).

4. *Combinations of Heat, Moisture, and Atmospheric Pressure, and their Effects.*

Wind.

(1.) *Wind* arises from the contact of warmer, and therefore lighter and ascending masses of air with colder, and therefore heavier and descending masses. The two great currents of wind which are produced by the equatorial current and the polar current of the atmosphere, are affected by various and especially by local influences, the latter of which are also capable of producing local winds. Wind observations in certain places—for example, in

valleys—are therefore of no use in climatic investigations. The peculiarities of the wind are caused by its origin: continental winds are dry; with us they are warm in summer and cold in winter. Sea-winds are characterised by the contrary effect on the feelings. Wind is to be taken into consideration—1. From its influence on the temperature and moistness of the place; and, 2. From the direct effect of its properties upon the body. As regards the first point, we may say—*a*, that a warm wind—therefore in the German summer an east and a south wind, and in the southern winter a south and a west wind—raises the temperature; and thus, especially when it is itself dry, as the south and east winds are with us in summer, the atmosphere is rendered more inclined to the reception of moisture, and evaporation is promoted. As examples of this we may mention the dry Leste in Madeira, the Harmattan in the Cape de Verd Islands, and the Tramontana and Bora in Italy. By this means heat is rendered latent, and the difference of temperature is equalised with varying rapidity. The dry Harmattan, blowing on the otherwise very damp Cape de Verd Islands, very easily therefore produces cold. During its duration old ulcers cease to discharge, and the inoculation of vaccine is ineffectual. *b*. A cold wind lowers the temperature. If it meet a highly saturated atmosphere, mist, clouds, and damp dews are produced, and if the difference be great, snow. From its lower temperature it causes a diminution of absolute moisture, and still more so if moisture be precipitated by rain, &c., although it increases the figure of relative moisture. Consequently, a change of the wind from warm to cold has always a drying effect. In December, 1868, I observed in Venice, on a change from the Sirocco to the Tramontana, within twenty-four hours, a diminution of absolute moisture from 3.83 to 1.30 lines. This rapid and dangerous change from south to north wind is characteristic of Rome. In Algiers, the difference of the two thermometers of the psychrometer is usually 2° R. (4.5° Fahr.). Once, from a Sirocco, the dry wind of the desert that blows there, it was 11° R. (24.75 Fahr.), thus evidencing an immense amount of dryness. At Ma-

deira the psychrometrical difference is on an average 2.0° to 3.4° Cent. (3.6° to 6.1° Fahr.). During the Leste, Hagen remarked an increase of this difference to 13.2° (!) (23.76° Fahr.). If the wind, like the north-west wind in the north-west of Germany, be cool, and, moreover, laden with moisture, coolness and rain or snow are the result.

As regards the second point: wind cools, owing to the rapid renewal of the strata of air coming into contact with the body and becoming warmed by it. The more rapid this renewal is, the greater is the cooling produced. A strong, but moderately cold wind may therefore seem cooler to us than a less strong but colder wind. The less violent and the warmer the wind, the slighter is its cooling effect. A still atmosphere at -30° R. (-35.5° Fahr.) is not found cold. In Siberia the cold is not felt in the open air (Mühry), though it is bitter at -4° (23° Fahr.) with wind. A still atmosphere at $+30^{\circ}$ R. (99.5° Fahr.) is insufferable. A dry wind below the temperature of the body cools, owing to the evaporation of water. Evaporation, according to Schübler, is double as great in windy weather as in still weather. In the north-east wind it is strongest, in the south-west wind weakest. The winds which interest us most on account of their occurring at 'official' health-resorts are—1. *The north wind*. The *Tramontana* and *Bora* in Italy is cold and dry; the barometer rises, the thermometer and the psychrometer fall. 2. *The Sirocco* (the south-east wind is thus nautically designated, but, generally speaking, this name, like the *Föhn* of the Swiss, is applied to every south wind!), on the southern slopes of Switzerland and in Upper Italy, is moist and warm; in Spain (where it is known as the *Solano*) and in south Italy, it is now and then dry, according to circumstances. In Italy, generally speaking, the thermometer and the dew-point rise when it prevails, but the barometer falls. Its effect is very marked: it is 'filled as with a warm, invisible vapour, which it diffuses, as it were, rendering the muscular energy and mental powers languid. It is the wind of indolence' (Mühry). When it prevails, 'the vital functions become inert, and the digestion retarded,

and even deranged' (Dove). In Venice its moistness is proved by the well-known moisture on the palaces and statues, the low temperature of which allows the dampness of the atmosphere to settle on them. 3. The *north-west* wind, the *Maestro* of Italy, the *Mistral* of the south of France, is moderately cool, but dry, and blows with great violence along the valley of the Rhone, and rages especially in Roussillon and Provence. It is accompanied with a falling of the barometer, diminution of absolute moisture, and a clear, cloudless sky.

(2.) *Clouds, Mist, and Rain.*—A so-called *clear sky* Rain, &c. only proves that a certain wind has prevailed for a period of time; *clear atmosphere* is a different thing. The air is clearest, bluest, and most transparent before a storm of rain, as the particles of dust floating in the air become heavier from the hygroscopic attraction of the moisture, and fall to the ground. The clearness of the tropical sky in the night arises from the warm current of air that rises or from the abundant formation of dew. The more free from vapour, but also the more free from dust, the purer and clearer is the sky. Unconditional inferences are not therefore to be drawn from the clear sky of a place with regard to its dampness or dryness. The want of clearness in the sky of Rome, which is enforced in favour of the suitability of the town for irritable phthisical patients, proves nothing with respect to the temperature and moisture of the place, whilst the picturesque, dusty atmosphere of Nice is only to be traced to the unpleasant consequences of a chalk soil, with few rainy days. With a clear sky, the light is, of course, stronger and more sensitively felt. This is a powerful stimulant to the organism and the mind; conditions of the greatest physical comfort occur by bright days; on gloomy ones we are less cheerful. This is the reason why to many physicians and sick persons the idea of an 'agreeable climate' is identical with that of an 'advantageous climate.' In no other malady are these to be more distinguished than in phthisis.

Clouds are parts of the atmosphere which are of a lower temperature, and *mist* is the same. They both

prove a cooling of the air as it rises, a disproportionately rapid radiation of heat or the occurrence of a colder current of air. Clouds and mist, therefore, occur most frequently in mountains and in places of very variable temperature; they are no standard of dampness only. There are very damp places, such as Madeira and Pisa, where mists are almost unknown, and very dry places, such as Nice and Hyères, where they are not unusual, and are even frequent.

A place may be very damp, and may have rain comparatively seldom, if the condensing and cold currents of air be rare. A constant fall of rain is a sign of moist air combined with frequent change of wind. Thus at Madeira and Pau the moisture of the atmosphere is greater than at any of the more important health-resorts; but the former has on an average only 93 days of rain, with 763 millim. (30 inches) of water, whilst Pau has 140 days of rain, with 1,090 millim. (43 inches) of water. The moisture of Venice is almost equal to Pau, and yet there are only 84 days of rain. On the other hand, Hyères is dry, with only 62 days of rain, but these produce 746 millim. of water, almost as much as the 93 days at Madeira! The most frequent winds at Hyères are, however, local extremes of cold and warm, of dryness and moisture, namely, the south-west and the north-west. The state of the hygrometer varies between 20 and 80. Nice is still more subject to extremes; it has few days of rain (72). These, however, discharge the large amount of 1,380 millim. (54.3 inches) of water. Its situation, with its constant wind and constant change of temperature, is the cause of this. We see, therefore, that the number of the days of rain can only be used in estimating the agreeableness of a climate. If this be regarded as influential in other diseases, or in cases of subsided phthisis, there is no objection to be raised; but the winter residence for active phthisis requires stricter estimation. There is much rain in the mountains, especially in summer, because the air, heated in the valley, comes into cooler regions as it rises up the mountains. It becomes colder, and thus its amount of water is condensed.

This falling down of condensed vapour occurs, as we may imagine, chiefly during the day. For the same reason, the Föhn of Switzerland, which, according to Dove, comes from the West Indian Ocean, produces rain or snow on the south side of the Alps, but on the north side it has a drier effect. The same circumstance may be observed at lower ranges of hills, as, for instance, in the Teutoburg Forest. Whilst at Paderborn and Gütersloh on the west side 28 Parisian inches of rain annually fall, the amount of rain at Salzuffeln on the east side is only 21·8. Snow proceeds from greater differences of temperature than rain. It seems to depend extraordinarily on local circumstances, if we consider that Nice has on an average 0·4 days of snow; Florence, 1·3; Rome, 1·6; Palermo, 2·6; Venice, 5·6; and Brescia, 10·7.

CHAPTER IV.

GENERALLY APPLICABLE CONDITIONS OF CURE—(*continued*).

II. RESIDENCE. DIET. SOCIAL CONDITIONS.

Residence. A FURTHER question, without a satisfactory answer to which no phthysical patient can be comfortably sent to his destination, is that of residence. What I think of the scattered and unsuperintended lodgings of our patients, I have already expressed on several occasions. The small size of our average summer-lodgings is a great evil. Nowhere at our health-resorts is there a Board of Health to decide in new buildings the amount of space required, the system of ventilation and its applicability, not to speak of other necessary arrangements. Considering the demoralisation which the narrow-minded selfishness of the short summer profit produces at our spas, I see for the present no remedy for this fearful blemish. The solid phalanx of the medical profession in England is able to extort from the simplest magistrate those necessary measures which we, year by year, must crave singly, and in vain. A question in connection with this subject is that of the necessary nursing. The nearest health-resort is for the most part to be preferred to the more distant, on account of the frequently desirable presence of relatives in cases of critical illness. The choice of such a companion, however, is of great importance. It is only thoroughly quiet and authoritative persons who are permanently equal to the task of aiding the physician in his efforts, and frequently of doing the most important part. The wife, hardened by the long illness of the husband, is his unsurpassable nurse, imperceptibly infusing mental benefits with the loving offices of her hands.

The *diet* of a phthisical patient ought to be of a special character only, if certain derangements of the digestive organs require attention, or if certain particular courses of treatment, such as milk-cures, are employed, the effect of which might be impeded by common food. These exceptions must, of course, be possible of arrangement at the place selected, and must not be left to the fancy of those employed in the kitchen, who endeavour to suit their convenience by pleading long use and the prescriptions of former physicians. Rarely is cooking done upon reasonable principles. Among the boarders at an hotel, cases of diarrhœa may be seen to succeed a meal, and this annihilates the results obtained, and is especially difficult to stop in phthisical patients. The hostess at the boarding-house wishes to give her guests good strengthening food, and she gives them that which the custom of the country understands as such. The meals consist of strong dishes of eggs and meat, of cabbage boiled in grease, of hard French beans, and even of heavy lumps of flour, perfectly indigestible to any stomach, and especially at the encouraging termination of a course of treatment, which is thus rendered fruitless. Moreover, man does not live on that which he eats, but on that which he digests. This practical inference should always be kept in view; instead of this, the idea of so-called strengthening food is more and more gaining ground. *The more out of health a man is, and the weaker therefore his stomach and his powers of assimilation, the more concentrated is the nourishment taken* (in extracts of meat, eggs, and malt-extracts), without reflecting that a certain *quantity* is necessary for the performance of the normal processes of the digestion. Or ought the human intestinal canal to be really superfluously long? The introduction of judgment into the kitchens of health-resorts, is a task the fulfilment of which belongs only to the utmost perseverance. The almost exclusive use of meat prescribed by many physicians, owing to the misunderstanding of Liebig's early works, is only advisable with quiet and vigorous constitutions, combined with the climatic influences of winter, mountain and sea air; inland residence and a low situation, summer-heat and feeble

Diet.

Maxims of
nutrition.

nervous constitutions require less substantial food, fat-forming substances and vegetables, and contra-indicate the predominant use of meat. The prohibition of all meat-diet is often of the greatest benefit, especially in cases of active phthisis and violent reaction after nitrogenous food.

[A most important point in the treatment of consumptive persons, and those threatened with consumption, is not only the nature of food, but also the amount and the manner in which it is given. The digestive powers of such patients are always more or less defective, although their appetites may be good. They are unable to digest large meals; they ought, therefore, to have frequent and less bulky meals, for instance, milk before rising, breakfast an hour later, milk two hours after breakfast, then an *early* dinner, milk again in the afternoon, a light supper at about seven, and milk on going to bed. If milk alone be not borne, it may be tried with some suitable addition, or some other simple food must be substituted.]

Fattening
cures.

I must here mention a peculiar tendency still obstinately adhered to, namely, that of combating against thinness in itself as a condition which is disposed to develop or to continue phthisis. In many cases, it is not to be denied that a remarkable improvement is apparent from large supplies of fat, but the more frequent evil results of these fattening remedies, as, for instance, of *cod-liver oil*, in affecting the appetite and the powers of assimilation, justify us in asserting their average injurious consequences, *unless* the physician keep the strictest surveillance over the invalid. In that case, a regular supply of fat may be attended with successful results. It has been said of cod-liver oil that it produces fatness of the liver; it is possible, although many cases of fatness of the liver may be regarded as the effect of a febrile increase of temperature. Cod-liver oil can, however, be supplanted in most cases by an innumerable quantity of other fat or oily substances; some health-resorts and their establishments, as, for instance, Brehmer's at Görbersdorf, are distinguished by the amount of fat-forming part of the food.

Generally speaking, the increase of fat in an individual

arises from diminished expenditure and increased reception. A diminution of expenditure, and therefore a retardation of the change of substance, may be produced by external circumstances, and may be referrible to certain physical conditions, such as emphysema. An increase of reception may be effected only when the digestive power is in thoroughly good order; but this cannot dispense with the tendency of the deposition of fat to remain good although the stimulant of exercise may be lacking. Certain articles of food, such as alcohol, act as saving influences (reducing expenditure), by diminishing the oxidation process, and lowering the temperature (alcohol, when it is taken continuously and in large doses); they can, therefore, have a fattening effect in individuals who in some measure lack the above-mentioned conditions, namely, *repose and strength of stomach*.

The dietetic and methodic use of *alcohol* and *wine* in Wine. cases of phthisis, which is thus justified, has become tolerably general. After having tried several kinds, I have at last fixed on the recommendation of a not too sweet Upper Hungarian wine. Brehmer considers the Hungarian wine the best, 'because phosphate of lime, combined with an organic basis, appears in it.' At the elevated health-resorts of Switzerland, the peculiarly earthy Veltliner wine is drank, with an equally good effect. The asserted effect of evening draughts of cognac or arrac in counteracting phthisical perspirations, I have never been able to observe. A course of fattening treatment is afforded by the *Koumiss cure* of the Kirghisis, Koumiss. which has recently been imitated in many places. The genuine koumiss is fermented mare's milk, and its analysis proves a plentiful amount of lactic acid, carbonic acid, and alcohol, as distinguishing it from fresh milk. These component parts render it an agreeable and thirst-quenching drink. The nomads of East and South Russia (Perm, Orenburg, and Samara) chiefly prepare it, and they also receive patients in their *auls*. They give the koumiss in large quantities. The effects are, generally, a tendency to fat and a sense of comfort. Similar effects are obtained in Stahlberg's establishment at Moscow; and

in the places where mineral waters prepared from snow water are used (Krasnaya, Zhemchuzhnaia, and others). According to Russian authorities, 15 cases of recovery, and 70 of improvement are obtained on an average in 100 treated by Kuzmina. All maladies which are successfully treated with Kuzmina must be of a torpid character. The internal use of exported Kuzmina is not advisable, as far as my own experience goes, and Kuzmina export is altogether inadvisable.

[Kuzmina is Kuzmina establishments, where the beverage is prepared from snow water, are at present to be found in many places: but quite recently Dr. Stahlberg has arranged a genuine Kuzmina establishment in *Wladikavkaz*, in Nossak, to which place he has brought a considerable number of waters from the Russian steppes: so that now, for the first time, the chance for a proper trial is given in a not too distant locality.]

Contra-
indications.

That the so-called *contra-indications* ought to exhibit the utmost degree of excellence and commendability, is evident. Baths badly given, and douches administered without technical judgment, have brought these remedies into discredit by their ill-success: even if—and this is not always the case—a strict choice be exercised in the cases selected. At the elevated health-resorts, where great importance is attached to cold douches, a physician always gives the douches. That all the arrangements should be under medical superintendence, is a matter of course, but this is for the most part so interpreted with us, that frequently the nominal superintendence of the medical authorities is regarded sufficient; a mistake often producing sad consequences.

The physi-
cian.

We have already taken occasion to point out how essential generally in phthisis is the *choice of the physician*. We shall see that in an accurate examination of the advantages offered by many health-resorts, the acknowledged excellence of the physician there is the sole distinction. 'If there be a well-spirit, it is not to be looked for in the waters, but in the physician' (G. Lange). Rapid comprehension of the individual case is the great task of the bath-physician; a task which, unfortunately only rarely facilitated by information on the subject from

the family physician, must very speedily be accomplished, as the period of treatment is mostly limited. The length of the treatment, however, ought, as we have already mentioned, to be left in every case to the physician.

Last, but not least, I come to *social relations*. The living together of those suffering from affections of the chest is so far different from that of other sick persons, as, among the former, the important malady and the things connected with it form an ever new subject of conversation. Certain innocent diversions are, therefore, of the greatest importance. Exciting amusements are not suitable; on the contrary, repose of body and mind, by which I do not of course mean for ever lying, and sitting, and doing nothing, is an especial requirement; quiet spas or health-resorts, which do not make much social demand on the patient, are to be preferred. For this reason, a revolt against Nice as a place of resort is justified in the case of most phthisical persons, because it is impossible to keep the sick there so far under control, and critical patients are occasionally to be seen turning in waltzes or joining in rapid galoppes. Amusements of this kind ought not to exist for phthisical persons, just as little as they ought to be exposed in Rome and Venice to unheated galleries and churches. [It is, on the whole, necessary to warn consumptive people against careless attendance on service in churches; for we know that many inflammatory attacks are caused either by the draughts in churches, or by the change of temperature in leaving them. A still more injurious custom for delicate persons is that of attending communion with an empty stomach; we can trace to this, in two cases, the origin of disease which proved fatal.]

Bodily exercise is of the greatest importance, and that place of resort is to be preferred where the nature of the ground and the arrangements allow the patients constant exercise, of course of a moderate kind. Mountain-climbing should be limited to mountains not very steep, and with good roads. On the whole, an undulating soil is to be preferred to a flat one, because the latter does not cause the walker to breathe freely. Passive exercise is

even of use to those who are seriously ill; quiet sleep and appetite are frequently obtained only by a drive in an easy carriage. Riding on quiet animals, which has been urgently recommended already by Sydenham, is a suitable prescription.

The principal measures which have at all times brought baths and climatic resorts into the field against phthisis, must be regarded as directed against the peculiar constitution of the body which the local affection of the lungs has either produced or found existing. The restoration of a better state of general health, and even of a better appearance, is consciously or unconsciously the aim in view, and the weighing machine is appealed to as umpire. If the over-great importance which is here and there attached to the result of these considerations must be regarded as one of those one-sidednesses to which the imperfect estimation of a condition is liable, there is nevertheless indisputable truth in its foundation. It is, above all, necessary to keep the body in a position to overcome the local affection, and to place it in a state to do so. *The ideal of a health-resort*, in which everything required for the uniform re-establishment of the deranged organism is combined, is not to be met with. Imperfections exist everywhere; in every place there is a certain amount of provision for the main indication, combined with a number of circumstances adapted to meet the symptomatic indication. Every other division, therefore, of these spas is more artificial than that which refers to the main points, which we have (p. 527) laid down as determining our mode of treatment, namely, the phase of the disease and the reactionary power of the sick person. For purely external reasons only, we shall separate mineral springs and climatic resorts into two principal classes.

CHAPTER V.

SPAS AND MODES OF TREATMENT IN CASES OF PHTHISIS,
ESPECIALLY ACTIVE PHTHISIS IN DELICATE PERSONS.

IN the following places, we have to deal with conditions which are adapted to weakly constitutions after inflammatory conditions of the lungs and the general indisposition thus produced. Equable and not too high temperature, great moisture of atmosphere, sheltered situation, and repose as regards social relations, distinguish almost all.

The *chemical constitution* of the springs has been treated of in the earlier sections of this work, and the only point differing from what is there stated is my opinion of the use of *lime* in *phthisis*. A solution of lime of digestible strength is not indifferent. Unsuitable as it is for some, even a stronger lime-water is suitable to the digestive organs of many others, and this also if combined with the so-called indigestible sulphate of lime. The supposition that part of it may be absorbed and is concerned to a certain extent in the general effect, is admissible. It is not possible that the ever-repeated experiences as to the effect of calcareous earth owe their origin to simple self-delusions. I may be allowed to state that two iron-springs of acknowledged good effect in the restoration of a weakened organism, namely, Pymont and Driburg, exhibit considerable quantities of lime, and that we are no less justified in attributing the effect to the great amount of lime than to the far lower one of iron. The small doses of *muriates and sulphates of alkalies* are for the most part entirely received into the blood from the stomach, on the membrane of which they produce a slight irritation. From experience we find a certain

Lime in
phthisis.Alkaline
muriates
and sul-
phates.

influence exercised on the circulation, and empiricism ascribes especially to small doses of Glauber's salt an influence in checking slight bleedings. A greater amount of *alkaline carbonates* requires much care in its use, owing to its powerful effect, and hence it is usually diluted with whey or milk. The amount of iron ascertained in some of these waters was formerly regarded as connected with the occurrence of bleeding of the lungs; but this symptom, as I have shown, in most cases proceeds from sudden increase of the quantity of blood caused by strong increase of atmospheric moisture.

Amount of
gas.

The amount of gas contained in these waters deserves to be more fully discussed with regard to its influence in active phthisis.

Carbonic
acid.

The *carbonic acid*, abundant in some springs, must be designated as injurious with respect to our purpose. Its introduction impedes the admission of oxygen to the blood-cells, and it therefore indirectly produces a diminution of nervous and muscular energy. The danger of the gas, as irritating the sensitive nerves, increases with the irritability of the individual. In cases of active phthisis, therefore, the mineral waters are rendered as free as possible from the gas by being heated, agitated, and allowed to stand. Some springs evolve also a varying

Nitrogen.

quantity of *nitrogen gas*. As the effect of these springs has been ascribed to this gas, and in spite of all counter-evidence this supposition is still maintained, I must enter into it more closely. It is strange that in those springs which produce by far the greater amount of nitrogen gas, a positive effect produced by this gas has never been ascertained, though the adherents of the theory see it so strikingly from the small amount at Lippspringe, the Inselbad, and New Ragoczi. According to Humboldt, the nitrogen-gas volcanoes (*Vulcanitos*) at Turbaco daily yield more than 3,000 cubic feet, and at the most there are $1\frac{1}{2}$ parts of oxygen to 100 parts of this gas. At a number of German baths, after the example of Lippspringe, the attempt has been made to render the amount of nitrogen gas useful by turning it to account. This is done for the most part in the form of so-called gas-

inhalations. The effect of these, to which credence is at any rate too readily given, consists simply in the effect of the inhalation of the pulverised fluid. The diminution of the pulse from two to thirteen beats proves nothing as regards nitrogen gas; for, next to typhoid fever, pulmonary phthisis manifests the most considerable differences of pulse, according to the position of the body, and these differences may be experienced when sitting in any apartment chosen. The indisputable fact in the inhalations at Lippspringe is that a considerable quantity of mineral water is pulverised, and that it saturates with vapour the air of the room at a temperature of from 14 to 17° R. (63·5° to 70·2 Fahr.). Lungs not too far advanced in disease feel comfortable in this atmosphere, the irritation to cough is allayed by the non-irritating air, and the sick person can draw a deep breath without coughing. If this atmosphere be made use of for regular exercise of the lungs (pulmonary gymnastics), great benefit is obtained; the patient acquires a flexibility of the thorax and lungs, such as he has not known for a long time; he admits air into many neglected parts of the lungs, and the breathing becomes freer. In a short time he learns to exercise his power also in the open air, and the result, after some time, is a considerable increase of the vital capacity of the lungs.

Merely remaining in the moist and quiet atmosphere is only of passing value. The unfavourable side of the treatment consists in the presence of a considerable quantity of carbonic acid, which often is rendered perceptible in excitable persons by producing the most oppressive headaches. This is not to be wondered at, if we consider that the air expired contains about $4\frac{1}{3}$ per cent. of carbonic acid, and that an equally great percentage of it in the atmosphere checks the change of gas in the blood.

All the springs recommended in cases of active phthisis accord with the climatic resorts adapted for the same state in the one point, namely, that a maturing of the catarrh, manifested by an *increase of expectoration*, very speedily takes place. This fact finds its explanation in the increase of the supply of water and in the diminution of the loss of water in a moist still atmosphere.

Criterion.
Increase of
expectora-
tion.

Under ordinary circumstances, the cutis yields about double the water exhaled, i.e., about 660 grammes daily. If the air to be inhaled, and which surrounds the body, is far richer in vapour than ordinary air, it is evident that not only of the 330 grammes of exhalation-water, but also the 660 grammes of skin-water—almost a kilogramme when added together—a sufficient quantity is retained in the body to give fluidity to the substances expectorated. (That this explanation is correct, we may infer also from the effect of frequent warm baths; for, in consequence of the increased action of the skin thus produced, the sputa of phthisical persons usually become much diminished, if they do not cease entirely, and increase again after the omission of the bath.) This explains the frequently surprising sudden effect which not only occurs in dry catarrh, but also in the cheesy deposits of the lungs. Mittermaier was the first, as far as I know, to draw attention to the effect of moisture as regards Madeira, and I can only confirm this as regards Lippspringe. The cheesy deposits soften, and are expectorated up to the line of demarcation, so that often in a few weeks cavities tending to cicatrization may be discovered, with diminution of the purulent sputa, provided that the nutrition has in the meanwhile been improved. This method of letting the cheesy deposits be expectorated seems to me by far *the most to be recommended*, and, with judicious care, the least dangerous. *For there is here no other mode of curing*, but softening, ulceration and healing; and as the presence of cheesy products forms the greatest cause for the origin of general miliary tuberculosis, a disease hitherto defying all treatment, we are bound to endeavour to eliminate these fatal deposits. From my investigations at Lippspringe, it is evident that fever appears as the softening takes place, and that it is the more violent the more extensive the softening parts, and the more sudden the softening. At the same time, however, it is apparent that the softening may be regulated by careful attention apart from very extensive disease, and that even the fever can be rendered almost null if the physician have succeeded in adequately raising the strength of the patient. The occurrence of a kind

of formation of sequestra combined with granulation may be then supposed, evidence of which is given by the readily occurring capillary bleedings, the counteraction of which for the most part requires only slight change of regimen. The œdematous swelling also of the submucous tissue of the larynx, of which Mittermaier speaks, I have often observed. In limited ulcers of this organ, the effect of this was not bad; extensive alterations of long standing were not favourably influenced, and required the use of astringents. In other places—as, for instance, Pierrefonds—the same unsatisfactory result from vapour in ulceration of the larynx has been observed.

At most spas, there are arrangements which serve the purpose of directing the curative remedy directly to the diseased part of the respiratory organs, from the simple inhalation-apparatus to the *inhalation-apartments* on a large scale, which can be used by a number of sick persons at the same time. At page 551 this subject has been already touched upon, and its advantages have been mentioned as inducing pulmonary gymnastics, which are almost always desirable. An atmosphere is produced approaching the point of saturation, and it is, moreover, for the most part filled with minute bubbles of water. That these water-bubbles enter the bronchial tubes is indubitable, though it is not ascertained whether many of them find their way into the finest ramifications. Some of these inhalations—for instance, those from saline solutions, such as we find in many sool-baths—seem to produce an effect by stimulating the bronchial nerves, causing vigorous contractions of the muscular tissue, and thus promoting expectoration. This explains the statement confirmed by experience, that it is chiefly old bronchial catarrhs, with diffuse bronchial dilatation and stationary cavities, with abundant secretion, which derive comfort from these methods, at any rate from those where the diffused sool is rich enough. In the Reichenhall Inhalatorium, a cubic metre of air contains from 6 to 40 grammes of salt, according to the distance from the apparatus. Not wholly improbable, according to experiment, is the supposition that the amount of alkalies in the inhaled water increases the ciliary motion;

Inhalation-apartments.

a simple and sufficient explanation, however, is, that the water inhaled softens the secretions and the epithelium; the more so as weak solutions of different non-irritating substances produce, when inhaled, the same effect.

Baths.

Douches.

Another far more important method has been at all times usual at these places, though for a period erroneously repressed, namely, *baths* of various kinds, to which *douches* have recently been added. For the general characteristics of warm baths, I refer to the chapter on the subject (page 123 *et seq.*), but I cannot forbear mentioning the excellent investigations of Heymann (Wiesbaden), the results of which are especially interesting as demonstrating the treatment of active phthisis by moist warmth; the nerves of the skin lose irritability in the state of saturation, whilst in that of abnormal dryness they gain irritability. By the help of the well-known Pflüger's law (which attributes to the motor nerves an avalanche-like increase of excitation on their way to the muscles), we may conclude that this inhibition of molecular action, at numerous nerve-terminations, produced by saturation, must give rise to general quieting of the nerve-centres, and through them of the whole nervous system. Baths of indifferent heat may be considered as hygienic emollients of unsurpassable efficacy in phthisis, and they are all the more urgently indicated, the more neglected the organ of the skin is found to be in the individual case. The opinion that a warm bath or any bath at all may produce hæmoptysis, I must, after thousands of experiments, declare to be thoroughly unfounded. On the contrary, many cases of obstinate spitting of blood have been checked by suitable lukewarm or warm baths, even when they have defied all other remedies. Moreover, according to my own observation, frequent baths are capable of diminishing the secretion of the lungs.¹ I repeat, lastly, the statement already made above, namely, that the influence of lukewarm baths on persons suffering from affections of the lungs is to be ascribed to the promotion of cutaneous perspiration as supplying the place of the deficient expiration from the lungs. The only danger of

¹ See p. 551.

warm baths lies in the failing of the energy of the heart, and chiefly for this reason great care must be taken with regard to the cases adopted for the remedy. Organisms with little vascular tone, and old and sluggish hearts, may be treated more safely with excitation of the skin, cold douches, and frictions.

The use of *cold in conditions of fever*, especially in the form of cold water douches, is empirically vindicated. The diminution of warmth by direct cooling seems to be of less importance than the vigorous stimulation of the nerves. In discussing fever, we stated that a class of antifebrile remedies were very probably efficacious, owing to the transmission of the irritation produced by them to the medulla which was weakened by fever. Every practitioner can recall to mind certain cases, especially of intermittent fever, cured by means of drinks exciting nausea, by great pain, and even by purely psychical influences. In my experience, the stimulant of cold belongs to this motley *armamentarium nervosum* in cases of phthisical fever. It must be expressly mentioned, and it is to be turned to account as confirming my opinion, that the result is very variable, fluctuating between the immediate removal of the fever and its undisturbed progress. The reason for this is yet to be investigated.

Cold water
treatment.

The statements of different authors as to the salutary effects of their springs in cases of phthisis, differ widely, frequently so widely that the one says the contrary to that which the other asserts, both alike resting their statements on prolonged experience of the same spring. For this reason, it is necessary to take into consideration the entire curative apparatus, including climate, the circumstances of the place, and lastly, good experience, i.e. the majority of reliable statements.

Lippspringe, a small town with 2,000 inhabitants, situated 441 feet above the sea, near the Teutoburg Forest, about two hours from the railway station of Paderborn, on a soil of chalk and sand, has a lime-spring, with a temperature of 17° R. (70·25° Fahr.), containing 6½ grains of Glauber's salt, and 0·1 grain of iron, very little carbonic

Lipp-
springe.

acid, and comparatively a great deal of nitrogen gas. It is a quiet place, tedious to many persons, and, apart from the possibility of making a few beautiful excursions, it affords no variety. The food is not bad, the rooms are for the most part too small, and the expenses moderate.

Taken in large quantities, from 30 to 36 ounces, the Lippspringe water acts for the most part as a gentle aperient; in a few cases, small doses of about 12 ounces produce constipation; and taken in medium doses it generally regulates the digestion. An appetite and a power of assimilation, which enable phthisical patients with extensive destructions of tissue to increase 10 pounds in weight in four weeks, and 21 pounds in thirteen weeks, are certainly important results. It is probably the heat of the water and its slight amount of gas, which, when taken fasting, facilitate the expectoration. Whether the water assists in the softening and expectoration of the cheesy deposit, and in the loosening of the accompanying catarrh, I know not. It seems to me, as I have already intimated, that the great moisture of the atmosphere, which keeps back the water of the lungs and skin, assisted by the increased ingestion of water, produces this effect. This occurs at various periods after the beginning of the course of treatment; with slight fever and moderate suppuration, the diseased part is gradually expectorated; and in many cases, by prolonged treatment, regulated accordingly, a cure of the cavity thus created may be ascertained. A continuation of the treatment at a drier place, as in the mountains, seems to promote this cure. The climate with its equable temperature has no high maximum; it has an uniformly high relative moisture, and the atmospheric pressure reaches a tolerably high degree. In all three points great variations are rare, the evenings and mornings are warmer, and the hottest noons not so warm as in other places lying in the same degree of latitude. Cool and moist west winds, especially north-west, are those that chiefly prevail. The medical arrangements are moderately good. Twenty-six baths do not meet the requirement, still less so do the douches, and only one of the inhalation-apartments is large enough. Thorough alterations are urgently

called for. The promenades are beautiful, and tolerably extensive.¹ (Drs. Dammann, Neumann, Rohden, Wolff.)

On account of its amount of nitrogen gas, the *Inselbad*, near Paderborn, is often mentioned with Lippspringe.² The weak salt-spring there (6 grains of chloride of sodium, and 2 grains of carbonate of lime) is considered by Hörling efficacious in cases of spitting of blood, and the inhalation of nitrogen gas plays a principal part in the method of treatment. With regard to the nitrogen gas inhalation, see pp. 317 and 432. (Dr. Hörling.)

Neuragoczi, near Halle, on the Saale, possessing likewise weak salt-springs, containing carbonic acid and nitrogen gas, is considered, on account of the latter, to be specially efficacious for phthisical patients. (Physician : Dr. Steinbrück.) Neuragoczi.

Weissenburg,³ with its sulphate-of-lime thermæ 22° R. (81·5 Fahr.) warm, is famed in the same cases as Lippspringe. Weissenburg. Pleuritic exudations are said, as at Lippspringe, to be very rapidly absorbed. The air of the narrow ravine, 2,758 feet above the sea, is described as very moist. The weather, nevertheless, is very variable on account of its mountainous position; sunshine (even in June and July, only for four or five hours), rain, and even snow often follow each other in quick succession. At the commencement of the course of treatment an excited state is said to be produced (the high situation?). Large doses have a dyspeptic effect, and cause, it is alleged, bleedings; 6 to 8 glasses act as a purgative. Baths and douches are 'no longer' given in cases of phthisis. The reason for this is not stated. The arrangements, both as regards lodging and superintendence, are similar to those of other small Swiss bathing resorts. The visitors are for the most part Swiss. Charges moderate. (Dr. Müller.)

Soden, on the Taunus,⁴ has, it is true, average Soden. temperatures which are lower than those of Frankfurt and Wiesbaden. It is, however, owing to great heat in

¹ *Rohden*. Lippspringe, Berlin, Euslin, 1871.

² See p. 432.

³ See p. 431.

⁴ See pp. 213 and 405.

summer, adapted for cases of active phthisis only in the spring and autumn months, although more highly situated spas in the Taunus are more easily reached. The average relative moisture is lower than at Lippspringe, the atmospheric pressure is similar. The strong carbonic acid common-salt-springs containing iron, require cautious employment, and the 'real course of waters must not be begun until all feverish action is completely removed.' Females in whom, as is often the case, symptoms of phthisis accompany uterine disease, find the place advantageous, as well as all patients whose pulmonary affection is caused and kept up by derangements of the circulation, especially those of an abdominal character. Pleuritic exudations also seem to find good results from Soden. Its efficacy is, moreover, illustrated by the fact that impossible things have of late been imposed upon it, as has been the case for a long time with Lippspringe. The number of deaths increase. The physicians have worked out a well-considered mode of treatment, which makes amends for many imperfections in the waters, and has achieved important results, especially in local therapy. On the part of the town, the spa committee, assisted by two experienced physicians, have done great things in the way of buildings and public walks. The beautiful bath-house has 32 baths, 2 douche apartments, and another for 10 baths is in course of construction. Soden affords the enjoyment of quiet life in a neat country place, with good accommodation and agreeable society. The season is from the 15th May to the 15th September.

[The physicians are mentioned in the former part of the work, as also the circumstance that at *Falkenstein*, a few English miles from Soden, at an elevation of about 1,700 feet, in a fine and sheltered situation, an establishment is in the course of construction for the treatment of chronic affections of the lungs with a consumptive tendency.]

As a representative of the soot-baths which from climate and arrangements are adapted to cases of phthisis requiring delicate treatment, we may mention—

Salzungen,¹ which registers a number of results worthy of attention. The arrangements have been essentially increased by the joint-stock company whose property the spa has become, and the bath-house is constructed for 40 baths. The special excellence of the place is a large building for graduation enclosed in walls, the use of which is prescribed for six hours daily. Increase of expectoration is observed after preceding symptoms of irritation. Baths are not given in the feverish stage. Cheap living and a pleasant situation combine with other advantages in rendering the spa worthy of recommendation.

¹ See p. 228.

CHAPTER VI.

SPAS AND TREATMENT IN STATIONARY PHTHISIS AND STRONG CONSTITUTIONS.

MODES of treatment which presuppose a certain and frequently a considerable amount of strength of constitution, are adapted chiefly or exclusively for feverless and subsided phthisical conditions, and hence are to be used in cases in which prophylactic treatment holds a prominent place. This prophylactic treatment may consist, 1st, in the removal of the diseases of other organs, and, 2nd, in the endeavour to bring the lungs themselves back to the *status quo ante*. Both measures often result in diminishing the residual conditions, and here and there in completely removing the objectively perceptible local symptoms; both are kept in view at suitably arranged health-resorts, and the second especially is in many cases only a matter for judicious treatment. On the other hand, we have to specify a number of health-resorts, in which originally the constitution appears to be only improved by the generally healthful life, and the respiratory organs restored by peculiar circumstances of soil and climate, and in which, for the fulfilment of the first method, modes of treatment have been adopted which are considered to stand in the place of certain mineral-water cures.

The climatic conditions in this class no longer require to be considered so anxiously with regard to their mildness, as in the class we have just discussed. In some, even greater freshness of temperature and more marked undulations of weather are found desirable as stimulating indolent and enfeebled constitutions. Height of situation is the decisive point in a class of these resorts. The social relations of the spa require far less to be subjected to

restriction than in the former class, and may be regulated more according to the general ideas which the mental individuality of the sick person, as was stated in the introduction to this work, requires to be kept in view. The amount of stimulation, however, to which the sick person can be subjected, is to be regulated—

1. By his own former constitution ;
2. By the duration of his illness ;
3. By the régime to which he has been hitherto subjected.

We thus must recognise the danger of the spring for those sick persons who have been removed from all irritation by remaining in the house during the winter, and who have become almost incapable of resistance, and also the possibility of using tonic treatment with much less danger during the autumn and winter succeeding a well-employed summer, and other practical inferences which occur of themselves to the thoughtful physician.

One point in which the spas of this class harmonise with each other (in those treated of in the last chapter of course no stress could be laid upon it), is the tendency to *diminish expectoration*, which frequently forms the sole complaint of the sick person, who draws from it the inference that his lungs have not yet recovered their normal condition. The idea of simple physical desiccation from dryness of the air is the first to suggest itself. In dry places—as, for instance, at Cairo—a rapid desiccation of abundant fluid secretions is often observed (Reil); and perhaps a part of the diminution of secretion occurring at elevated health-resorts is to be ascribed to the smaller amount of absolute moisture.

Criterion.

Diminution of expectoration.

Connected with this subject are two therapeutic ideas which are occasionally dwelt upon at these health-resorts ; namely, the employment of sulphur and of tar.

1. *Sulphur*.—Sulphur is given in the most different forms, as flowers of sulphur, as sulphuret of potassium, as sulphur-water, as inhalation of pulverised sulphur-water, and as sulphuretted hydrogen. The remedy is used with especial predilection in France. From the results obtained

Sulphur.

by Claude Bernard, that the sulphur introduced into the body leaves it again for the most part through the lungs, theories have been raised as to the local effect of sulphur in irritating the mucous membrane of the lungs, counter-acting the tendency to excessive secretion; but these are scarcely to be received. Accurate observations are lacking. For courses of sulphur-waters, see p. 413. With respect to inhalations of pulverised sulphur-water and sulphuretted hydrogen, the confusion of the statements is so great, that some recommend both in cases of dry catarrh, and others in catarrh with excessive secretion. It seems as if these topical remedies produced diametrically opposite results, according as the spa is situated in the plains or in the mountains. If this be the case, sulphur, which is regarded with such superstitious reverence in France, may lose indeed much of its importance.

Tar. 2. *Tar.*—This has been used internally with excellent results for a long period, from juniper-berries to creasote and carbolic acid. The effect of tar as a locally irritating and antiseptic remedy is especially advantageous in the cases under discussion, in the so-called pauses of the malady, when no tendency to hæmoptysis exists, *i.e.*, therefore, for the most part when there are no signs of granulations or inflammatory affections. It is used in the most different forms by the stomach, and inhaled as vapour and as a pulverised watery solution. Much is said of the advantages arising to diseased lungs from inhaling the air of pine-forests; most of the spas and health-resorts situated in the vicinity of pine-forests speak of it as an aromatic and balmy air; possibly, a richer production of ozone may occur at these localities. In some spas, arrangements are made for the use of pine-wood by inhalation, as at Reichenhall and Ischl. Accurate observations are lacking.

Exercise. Another point has recently made urgent demands on the attention in the treatment of phthisis; namely, that of the *dilatation* of the *respiratory organs* which are either originally *narrow* or have been long neglected. Though the opinion expressed by Paul Niemeyer, in his clinical lectures,¹ that phthisis of the apex is scarcely possible

¹ Erlangen, 1873.

without imperfect action of the muscles of the shoulder, may be too exclusive, and the conclusions to be drawn from it (namely, that in those suffering from emphysema and in a condition of pregnancy, no apex-phthisis can occur or advance, because they are compelled to breathe with the apices of the lungs), may appear premature, yet the concurrence of phthisis with imperfect breathing, and the benefit of plentiful ventilation of the diseased lung are so evident, both as regards the organ and the organism, that any neglect of the physician in this respect must be characterised as a sin of omission. 'It is good, on the contrary, as soon as the febrile stage is ended, to incite the parts that have remained healthy to vicarious activity in ventilation, and subsequently, if possible, to render the diseased parts again capable of ventilation. Medical gymnastics obtain their object by prescribing attitudes of body which to a certain extent arrest the respiration of certain parts, and thus concentrate the ventilation on others.'¹ While speaking on the subject we may mention the *spirometer*. I confess that I lay much value on this instrument in cases only where it is necessary to ascertain the gradual progress in the mechanism of breathing made by a sick person. The spirometer, however, is of no great assistance in forming diagnoses, as the circumstances on which imperfect inhalation and exhalation may depend are very numerous, from the awkwardness and timidity of the patient. The so-called vital capacity of the lungs consists of—1, the activity of the respiratory muscles; 2, the range of motion of the diaphragm; 3, the elasticity of the substance of the lungs themselves; and, 4, their capacity of containing air.

Spirome-
ter.

From delight at the striking phenomena of the *pneumatic apparatus*, the attempt has been made to render pulmonary phthisis a subject also of pneumatic treatment; but in spite of all the efforts made, the matter is still one of inference only. The observations of good results are not pure; the described cases have been subjected to other modes of treatment; and to prove the cure of a mere phthisical disposition would, at any rate, be difficult; and

Condensed
air.

¹ P. Niemeyer's *Atmiatrie*, 1872, p. 27.

for the latter purpose the apparatus is chiefly extolled. A palliative result, at first in counteracting hyperæmia and catarrh, and subsequently in a slighter measure in alleviating dyspnoea and cough, may be honestly conceded to it, but nothing more. In order to produce a lasting result, arrangements must above all be made for a sojourn of weeks under high atmospheric pressure. The amount of gas admitted into the blood under high atmospheric pressure escapes, according to the old law of physics, on the removal of the pressure; in the same way the diminution of the frequency of the pulse is a temporary effect, as is also the diminished fulness of the capillaries.

As a therapeutic inference from the above remarks, it appears that, with innate or acquired deficiency in the mechanism of breathing, the patient may be brought into conditions in which he breathes freely, either consciously or unconsciously; that therefore, in young people especially, the thorax may be rendered more elastic, and even perhaps absolutely wider, and that the respiratory muscles may be brought into the best possible condition. To effect this, pneumatic apparatus is as little necessary as that imposing Faradisation of the respiratory muscles, such as some credulous and misguiding persons perform. But gradual exercise of the lungs, abundant exercise in the open air, in some cases regular mountain-climbing, when accompanied with favourable conditions of nutrition, and, above all, suitable superintendence by a physician who understands the individuality, are the most efficient methods; the carrying out of which, moreover—and this is no slight thing in their favour—is possible in almost all circumstances of life.

Cold water
treatment.

The *cold water system* in cases of phthisis is chiefly made use of in the temporary stimulus of cold by means of douches, friction, and cold baths of as short duration as possible. ‘Sick persons of this kind bear (for the most part) badly the application of medium temperatures (20 to 30° Cent.); water must, therefore, be used of a very stimulating degree of cold, and the loss of heat must be limited to the slightest amount by the short period the influence lasts. The bath produces all the more stimula-

ting effect on the vascular and nervous systems, the shorter the period for the quantum of heat withdrawn, and the mechanical irritation produced by the shock of the douche or rose acts essentially in promoting reaction.'¹ The use of cold water as a stimulus may be traced to the following physiological results. Stimulation of the skin has the effect of diminishing the pulse, of increasing the degree of contraction of the heart, of diminishing the temperature of the internal organs, because by the increased power of the heart greater masses of blood than before are propelled in a given time through the colder peripheric parts. Further, all withdrawal of heat from the external skin produces an increased production of carbonic acid, and this all the more, the greater the loss of heat. From these statements, it is evident why sick persons with languid hearts feel themselves relieved and refreshed after cold ablutions, and why sick persons especially, suffering from insufficiency of the main organ of oxydation and from anæmia, find a stimulant of this kind useful, especially under circumstances which depress the nervous power—for instance, in enervating heat. Sick persons, with a weak and frequent pulse, and with yellowish and flabby skin, are particularly suited to this mode of treatment. With regard to the use of cold as a stimulus in feverish phthisis,² another object of cold water treatment is the *hardening* of the weak skin of persons long ill. Sudden and violent transitions (in transition from great heat to a lower temperature the heat of the body falls, and indeed below the standard) are characterised by liability to cold.

These transitions can only be balanced in some measure by a vigorous skin, as its blood-vessels are not relaxed in the preceding heat to the same extent as those of a weak skin, but they contract powerfully on the influence of sudden cold, and thus prevent an excessive loss of heat. A systematic stimulation of the skin is, therefore, also indicated.

The method of allowing phthisical patients to make Sea-voyages.

¹ Runge

² See pp. 511 and 555.

long *sea-voyages* on vessels arranged for the purpose has been frequently suggested, but has never to my knowledge been properly carried out. The principle is excellent, judging from experience as to the advantageous effects of a *sea-voyage* in cases of stationary phthisis. Passive exercise and great psychical repose combine with the influence of the sea-air, which is ever in agitation, and is almost free from carbonic acid, in producing a frequently astonishing restoration of the whole organism, whilst the local disease also seems to be beneficially affected.

[Abstaining at present from entering into details on this very important subject, we only mention that we have had the opportunity of witnessing the effect of *sea-voyages* from 2½ to 14 months' duration in 19 cases of well-marked consumption: there was decided benefit in 9 cases, no prominent result in 5, and indubitable deterioration in 5. Much better results may probably be obtained with more suitable arrangements. It is, however, very difficult or impossible to lay down absolute rules for the selection of cases, although the psychical condition, the former experience of the patient himself, and that of his near relatives, may guide us in some degree. The *tendency to sea-sickness* is not always a forbidding element, though it is a disagreeable one; two of the nine satisfactory cases suffered frequently, while one of the five unsatisfactory never suffered from it. Three of the five indifferent cases and two of the five unsatisfactory did better on high elevations than on the sea, and the reverse was the case with two of the nine satisfactory cases. At the German Hospital, we see occasionally consumptive German mariners who have acquired their phthisis on board ship; while, on the other hand, two of our cases were cured by entering the mercantile navy.]

The treatment of affections of different organs in *causal connection* with phthisis, as bronchial catarrh and the remains of pneumonia, plethora of the abdomen, dyspepsia, etc., is principally represented in the following places.

Neuenahr,¹ situated in a valley of favourable climate. *Neuenahr*. The variations of temperature in the different parts of the days are light; the average degree of heat is high, and occasionally the heat is great. Maximum in 1872, 26·8° R. (above 92° Fahr.). The bath-arrangements are very good. The use of the springs is, according to the statements of the excellent Dr. Rich. Schmitz, 'contra-indicated in heart-complaints, in great vascular erethism, in inclination to hemorrhage, or congestion of the head and lungs, in weakness accompanied with irritability of the vascular system and nerves, and lastly, in acute inflammatory conditions.' The season is from 1st May to 15th October.

*Ems*² is notorious for the cases of hemorrhage which *Ems*. have come under observation there, and for years it has, therefore, been expressly proscribed. The majority of physicians recommend it for chronic bronchial catarrh, and not for phthisis; and we can only agree with them from consideration of the violent and strongly exciting effect of the warm springs. The position of the place causes exhausting heat during the day and cool evenings; and everyone will acknowledge that a noisy and fashionable spa is not the place for persons seriously ill. I only here mention it because it is, though imprudently, still frequently, from former habit, made use of in cases of phthisis.

*Weilbach*³ may be taken into consideration in those *Weilbach*. rare cases in which disease of the lungs is accompanied by enlargement of the liver and a very decided hæmorrhoidal condition, and in which no great degree of anæmia exists. The mistake of sending cases of laryngo-phthisis to Weilbach arises from the successful results of the treatment pursued there in cases of hyperæmia and catarrh of the larynx and pharynx, from passive congestion in consequence of impeded circulation in the abdominal organs. Life at Weilbach is quiet and almost solitary.

Gleichenberg, in Styria,⁴ an hour from the Feldbach *Gleichenberg*.

¹ See p. 344

² See pp. 290 and 420.

³ See p. 353.

⁴ See p. 352.

station, consists of a number of villas, standing in parks and gardens, in a lovely valley opening towards the south, with a warm but equable climate (the maximum in three years, 26° R. = 90.5° Fahr.), great moisture of atmosphere, though but little rain, two-thirds of the summer being on an average fine. The muriatic soda-springs, when used carefully, produce good results, and also the acidulated chalybeate. Baths of all kinds play an important part in the treatment; inhalations are used, also milk, whey, and decoctions of herbs. The arrangements are comfortable. Season, 1st May to 1st October.

Salz-
brunn.

*Salzbrunn*¹ lies 1,210 feet above the sea, in a broad and partly open valley. The climate, with its long cool spring, short summer, and mild autumn, 'acts as a powerful stimulant on the nerves and blood of enfeebled sick persons.' The Oberbrunnen, likewise a soda-water, is warmed and kept standing for the use of phthysical patients, in order that the carbonic acid may escape, and the lime and magnesia may sink to the bottom. There are 41 baths, some of them arranged with douches. The inhalations are of pulverised water. There is a grand whey-establishment. Biefel expressly protests against the climate for 'sick persons of constant feverish tendency,' and in 'erethic phthisis' he limits the treatment to whey; on the other hand, good results have been obtained in cases of old and stationary phthisis by the qualities that Salzbrunn possesses; from its elevated position, cases of dyspeptic and catarrhal phthisis are especially suited for the springs. Rate of charge moderate; the life quiet.

The high position of Salzbrunn to some extent prevents the appreciation of the effect of its waters on phthisis; and this is still more the case in some other baths which will presently be mentioned, which produce the same results in the same way as other spas, the efficacy of which admits of no other explanation than that of *an invigoration and strengthening of the organism generally by more advantageous general conditions*. Nevertheless,

¹ See p. 348.

these do not wholly dispense with a certain particularisation of the treatment ; and in weak mineral springs, and in establishments for whey and decoctions of herbs, remedies are afforded which are difficult of appreciation, because the general conditions in themselves exercise so powerful an influence on the organism. For the first time, we now meet with the effect of a certain elevation above the sea. Referring to the views which were explained in the introduction of this work (page 52 *et seq*), we may specify this effect as a facilitating of the change of substance, combined with more or less stimulation of the nervous system, according to the locality. In some 'torpid' cases of old phthisis the strong effect of sea-air may be recommended ; in summer, the coasts of the Channel and North Sea on this (the German) side, and in winter on the other or English side. We shall presently consider the remarkable English South coasts, as better adapted for winter treatment.

As regards *whey-cures*, I refer the reader to the remarks already made at page 433. A *decoction of herbs* must be considered as a pharmaceutical preparation, especially when, as at various spas, the fresh *digitalis* is one of the herbs used.

Whey-cures.
Decoction of herbs.

It is of course not possible to mention, even by name, every place which might be here spoken of ; and the number of *cool summer-resorts* especially is legion. They are subject to fashion, and their popularity for the most part is based on the fancy of some celebrity. That the good ones within reach frequently hold an inferior position, lies in the nature of the public, who are glad to assert themselves as travellers, and delight in improving their social position with their health. I shall, therefore, only mention the most important.¹

Summer-resorts.

¹ [England, Wales, and Scotland possess many localities which would be specially adapted to become summer health-resorts of medium elevation ; but generally there are no proper hotels or establishments for the reception of numerous visitors, and such establishments are mostly discouraged by the landed proprietors in whose hands are the most eligible localities. Such is the case with the moors of Scotland and Yorkshire, with their wonderfully enlivening air. A small inn, a few cottages, and scattered

Rehburg. *Rehburg*,¹ a pleasant little place on the Steinhuder Sea, with agreeable wooded environs and good medical treatment.

Grund. *Grund*, in the Harz mountains, 984 feet above the sea, in a very sheltered situation, somewhat rainy and tedious in rainy weather; the accommodation and food are tolerably good, and the prices low. Dr. Brockmann, a physician well acquainted with the Harz, limits the suitability of Grund to those cases of phthisis 'which are free from phlogistic irritation, and from any great degree of congestion.'

Teinach. *Teinach*, a small village in the Würtemberg Black Forest, at an elevation of 1,223 feet above the sea, lies in a delightful and sheltered position in a woody valley. The nightly dew-fall and the brief shining of the sun in the narrow valley, keep the daily temperature, even in mid-summer, within moderate limits. The mornings and evenings are especially fresh, and require care. In remedial resources it possesses, besides some earthy alkaline chalybeates, an excellent cold water establishment, herb decoctions, gymnastics, and electricity. Season from the 15th June to 15th September. (Dr. Wurm.)

Friedrichsrode. *Friedrichsrode*, 1,342 feet above the sea, situated four hours from Eisenach, seems unfortunately to have changed the character of a health-resort for invalids for that of a gay summer-resort for the healthy; hence it can only be made use of with caution.

Reichenhall. *Reichenhall*, 1,407 feet above the sea,² a railway station in Southern Bavaria, is much in fashion. The successful results in phthisis are variously recorded, because no discrimination is exercised among the cases sent there. The temperature is on the whole moderate,

houses, rarely disengaged, is all that is to be had; and the social element is wanting, even if one be fortunate enough to obtain accommodation. Not far from London there might be the most enviable summer-resorts; on the Surrey land-hills, near *Leith Hill* and the *Ewhurst Windmill*, or on the *Hindhead* or the *Blackdown*, near *Haslemere*; or farther away, on *Dartmoor* or on the *South Downs*; but all these beautiful places offer no accommodation. *Ilkley Wells*, *Malvern*, and *Tunbridge Wells* are favourable exceptions as far as they go.]

¹ See p. 440.

² See p. 226.

yet the heat can be extremely oppressive. The accommodation and food are said to have improved. Reichenhall ought to be regarded as too lively a place for most cases of phthisis.

Badenweiler, in the Baden Black Forest, very beautifully situated at an elevation of 1,425 feet above the sea, is at the present time in vogue, owing to its good arrangements and to the constant care of the Government. The temperature is very equable, and west winds predominate. Residence there is agreeable and comfortable, the numerous visitors for the most part belonging to the better class of Germans, 27 per cent. being on an average foreigners. With regard to the thermal baths there, see page 181. Badenweiler.

Charlottenbrunn, 1,450 feet high, situated in the Silesian Reisingebirge, a mile from the station of Waldenburg, possesses an important whey-establishment, an iron-spring (0.2 of carbonate of oxide of iron), and an acidulated spring. Charlottenbrunn.

I have intentionally arranged the spas under consideration according to their height above the sea, in order now at a suitable place to mention a class of health-resorts which claim a special position for themselves, namely—

Elevated Health-resorts.

These health-resorts have recently attracted the most eager attention. Indubitable results, the genesis of which it was difficult to estimate, were accompanied by a rejoicing, which, promising unprecedented things, completely occupied the startled minds of practitioners, and in spite of some bad experiences in unsuitable cases indiscriminately sent to these health-resorts, still partially continue to occupy them. A more extensive consideration of this subject, which is still in suspense, is, therefore, necessary.

The main reason for the recommendation of almost all these places rested in their freedom from phthisis. I refer to page 503. We there proved that freedom from phthisical disposition is a peculiarity of race belonging

to the people inhabiting those regions, and that therefore no absolute immunity exists, that is, no impossibility to suffer there from phthisis. With this immunity we have, therefore, nothing more to do, and we turn at once to the question, what peculiarities are they which in these highly situated places produce a favourable effect on phthysical conditions, or are alleged to do so?

Atmospheric pressure.

1. *Decrease of atmospheric pressure.*¹—The gases of the blood and lymph play the principal part in this. The blood contains a variable quantity of carbonic acid, oxygen, and nitrogen (lymph of dogs 20 to 40 per cent. carbonic acid), the first two of which are simply diffused, and are in part only in chemical combination, oxygen as the larger part and carbonic acid as the smaller part. These gases are partially removable by diminution of the atmospheric pressure; and indeed, by lessening the pressure, as much is rendered free as is required for the restoration of an equilibrium between the external pressure and the expansion of gases in the blood. In sudden and excessive changes of pressure this process is, of course, dangerous; for instance, in the diving-bell; in slow, continuous changes, not kept within too narrow limits, no considerable reaction immediately takes place. It is, however, an important question whether the change in the constitution of the blood, owing to the removal of a certain quantity of these gases, necessitates the production of any effect on the organism. We shall presently investigate this probability more closely. Further, to sudden variations of atmospheric pressure a certain importance may be ascribed, from the consideration that the atmospheric pressure shown by the barometer arises from the pressure of the dry air, and of the water-vapour held in solution in it. Any other result of the atmospheric pressure on the body must be regarded as illusory, and it has especially nothing to do with preserving its continuity. Brehmer, at Görbersdorf, starting with the false premises that phthisis proceeds from inanition of the lungs in consequence of too small a heart, and grounding his theory on the observation that in the diminution of

¹ See p. 536.

atmospheric pressure (as in every fluctuation of the atmosphere) at first the number of pulsations increases, imagined he had discovered in the diminished atmospheric pressure of high situations the natural reparation for this misproportion of too small a heart. One of the most decided adherents of his system, to whom I likewise belong, has proved the incorrectness of his premises and his inferences. The result he has arrived at accords with my own opinion, namely, that diminished atmospheric pressure is in itself wholly without influence on the progress of disease.

2. *Diminution of the oxygen of the air.*—This is Oxygen. regarded by many as reducing fever and preventing consumption, by others as an influence causing the sick person instinctively to respire more deeply. The first assumption is not tenable, for the reasons given on page 51 of this work; and the second is not tenable, because, from the investigations of W. Müller, the respiration is tolerably independent of the amount of oxygen in the air, and the depth of the inspiration is in nowise affected by it. From some remarks by Saussure, and an analysis of the air by Bischof, Brehmer has drawn the hasty conclusion that a certain minus of oxygen in the air of glaciers and everlasting snow is to blame for various maladies; for instance, the mountain-sickness of the Cordilleras; and that, at any rate, for this reason, the vicinity of glaciers is unfavourable to elevated health-resorts. *Glaciers* have a cooling effect on their surroundings, but this is all the influence they possess.

[Probably the air of glaciers has other, and on some Glaciers. constitutions favourable, influences. On ourselves and on others, we have often observed a peculiarly refreshing and exhilarating effect from a stay of some hours on or near glaciers. Three or four days on glaciers have repeatedly revived and strengthened us more than three or four weeks of mountaineering in similar elevations in Switzerland without glacier-work; and this experience coincides with that of other mountaineers. The thermometer alone gave no explanation. Possibly the purity of the air, *i.e.* the absence of organic impurities, and

possibly also an increased amount of ozone produced by evaporation, have a share in the effect. In suitable cases we have recommended walking and sitting on glaciers for its invigorating effect."

Dryness.

3. *Greater dryness of air.*—The small amount of vapour in mountain-air arises from the fact that the capacity of the air for retaining vapour diminishes with its temperature and density. The absolute quantity of water contained in a cubic foot of air amounts in summer to six or seven grains, and in winter only to one or two, a fact which may be applied to the conditions of high mountainous districts with their average lower temperature of air. It is the great difference in the capacity for holding water in solution existing between the air of the lungs, 37° C. (98.6° Fahr.) warm, and the far colder atmospheric air, which in this case causes the water of the body to pass into the air. From this it is evident that the most rapid desiccation both on heights and in valleys takes place on bright winter days; and as the latter are more frequent on elevations of 4,000 or 5,000 feet than in the plains, a plus in the loss of water may certainly be conceded to the long Alpine winter, especially as a lower degree of atmospheric pressure accelerates the formation of vapour. But that this plus drains the body, especially the secretions of the lungs, considerably more than below, is not to be inferred, as slight variations in the amount of water in the body are easily repaired. To the smaller amount of water in the air is to be imputed the justly admired *frequency of a clear sky* in high mountain districts. The origin of this very essential and agreeable property is connected with frost, which does not allow the dampness of the soil to evaporate, or with cold currents of air, which rapidly deposit the water held in solution in the air, or lastly, with the continuance of dry winds. As all three causes only occur in the winter, the winter in high mountainous districts has absolutely an advantage over the summer, and equally so over the North-west German and English winters of level lands. The Russian and North American winters present pretty much the same clearness. Great dryness of air allows the rays

of the sun to pass without having much of their warmth absorbed. Under these circumstances, therefore, very high temperatures appear in the sun, as much as 42° R. (126.5° Fahr.), while in the shade the temperature may be very low. This enables the sick person to remain in the open air for a greater length of time when the sky is bright than in the lower regions.¹

4. *Peculiar effects on the organism.*—In a number of persons a period of acclimatisation takes place, marked by uneasy sleep and by a considerable increase in the frequency of the pulse. In a few only this period lasts insufferably long, so that sojourn on the heights is rendered impossible to them. Among the exceptions may be numbered the observation of a condition of the kind on the height of Aussee, 2,080 feet (Schreiber). After this period the only striking effect is a greater power of digestion, more vigorous functions of assimilation, and the rapid passing away of the stupefying effects of wine, &c. Physical exertion in the mountains requires a frequent supply of food and rest; in very high situations of more than 10,000 feet a peculiar condition may be observed in this case, characterised by rapid sinking of the temperature (to as much as 5° C. or 9° Fahr.), extreme shortness of the inspirations, small and frequent pulse, and symptoms of altered functions of the brain. All cases of this kind experience immediate recovery from food and rest; and the Indian of the Cordilleras retards his change of substance by chewing coca, which contains caffein, and he thus remains in health. Garlic also is used in Peru as a popular remedy for the mountain-sickness. Lastly, inflammatory diseases are frequent, the cure of which requires from the beginning wine and strengthening food. There is no inclination in diseases occurring on high mountainous districts to become chronic.

5. *The therapeutic method* is, to a certain extent, empirical, and is, therefore, not unimportant for our consideration. It consists in an unusual abandonment to the

Peculiarities.

Method.

¹ See note on some Winter Thermometric Observations in the Alps. By Professor E. Frankland, F.R.S. *Proc. of the Royal Society*, vol. xxii. p. 317, 1874.

generally suitable influences of nature. The sick person is exposed unhindered to the air, which below he had avoided; he is fed with the food of health, which is more adequate to his stomach than that adapted for the sick; he is allowed to drink wine and spirits; he is encouraged to take physical exercise—a mode of treatment almost always contrary to that hitherto pursued. Even this alone is, from experience, capable of reviving phthisical patients of the average stationary kind, as may be seen also in the lowlands, when the supervision of the physician is rigid enough, and the confidence in him strong enough. The douche has a similar effect in the mountains as in the lowlands.

Physiological deduction.

From a *résumé* of the above, we obtain the following physiological points.

In the diminution of the gases of the blood and lymph, combined with a decrease of pressure, the main part is played by carbonic acid, on account of its quantum far exceeding that of the other gases. The not yet adequately studied poverty of the blood as regards this gas, which most probably forms the great stimulus to the nervous system of the heart, necessarily produces an effect contrary to that of its excess, which has been frequently observed. This consists, as is well known, in increase of arterial pressure, in a slackening of the pulse, and in the contraction of all small arteries. The phenomena of the circulation during a sojourn on great elevations are just the contrary; the frequency of the pulse is increased, but weakness of the propulsive power of the heart is observed, accompanied with relative emptiness of the arteries. Further, in lower regions the increased production of carbonic acid is followed by an increased loss of it; the blood, with slight variations, retaining the same quantity of carbonic acid. If in increased elevations the blood be physically deprived of its wonted amount of gas, the body endeavours to cover the deficiency by more rapid tissue-change, by means of oxidation. This explains the want of fat in the inhabitants of higher regions, and the extreme demand for food, not by those dwelling in the mountains, but by those belonging to the plains, who visit the mountains for a time.

Diminution of the heat of the body during physical exertion, and its restoration in repose.—A strange phenomenon ! In level lands, heat is produced by labour; here the reverse is the case. Is this the result of a greater giving off of heat to the surrounding air, so that the labour finds a smaller store of heat existing, and consequently causes speedy exhaustion, or is less heat produced ? It is among the conditions belonging to level lands that a person in repose merely parts with heat, while one at work changes 1-7th of his heat into mechanical action. The fact that the heat of the mountain-climber is speedily again restored by repose, allows us to infer that, as a matter of course, in increased loss of heat by evaporation, by heating of the air respired, and by radiation of heat, a considerable diminution takes place in the production of heat. By what is this caused ? In no-wise by diminution of heat-liberating oxidation; for food and rest the latter, generally diminishing oxidation, raise the temperature immediately to its normal condition. The fact, therefore, still lies before us unexplained. That the chemical processes are diminished by the rarefaction of the air, as Wunderlich maintains, so that in physical repose they are just sufficient to maintain the normal temperature, cannot be assumed without difficulty, because the reception of food could not then possibly have so striking an effect. More justifiable would be the assumption that the minus of heat is produced by the great change taking place in the circulation of the blood, or that we have before us a case of neurosis, like sea-sickness, which is not improbable, from the strength of the phenomenon varying according to individuals, parts of the world, winds, habits, and external circumstances.

[It is by no means a rule without exception that the temperature of the body sinks under the influence of exercise in high elevations. Dr. Clifford Allbutt found on himself in many trials that, as a rule, exertion caused a slight rise of temperature, while rest following exertion brought it down to the usual level. He concludes, from his experiments, that depression of temperature during exertion signifies either deficiency of food or ineffi-

Rehburg. *Rehburg*,¹ a pleasant little place on the Steinhuder Sea, with agreeable wooded environs and good medical treatment.

Grund. *Grund*, in the Harz mountains, 984 feet above the sea, in a very sheltered situation, somewhat rainy and tedious in rainy weather; the accommodation and food are tolerably good, and the prices low. Dr. Brockmann, a physician well acquainted with the Harz, limits the suitability of Grund to those cases of phthisis 'which are free from phlogistic irritation, and from any great degree of congestion.'

Teinach. *Teinach*, a small village in the Württemberg Black Forest, at an elevation of 1,223 feet above the sea, lies in a delightful and sheltered position in a woody valley. The nightly dew-fall and the brief shining of the sun in the narrow valley, keep the daily temperature, even in mid-summer, within moderate limits. The mornings and evenings are especially fresh, and require care. In remedial resources it possesses, besides some earthy alkaline chalybeates, an excellent cold water establishment, herb decoctions, gymnastics, and electricity. Season from the 15th June to 15th September. (Dr. Wurm.)

Friedrichsrode. *Friedrichsrode*, 1,342 feet above the sea, situated four hours from Eisenach, seems unfortunately to have changed the character of a health-resort for invalids for that of a gay summer-resort for the healthy; hence it can only be made use of with caution.

Reichenhall. *Reichenhall*, 1,407 feet above the sea,² a railway station in Southern Bavaria, is much in fashion. The successful results in phthisis are variously recorded, because no discrimination is exercised among the cases sent there. The temperature is on the whole moderate,

houses, rarely disengaged, is all that is to be had; and the social element is wanting, even if one be fortunate enough to obtain accommodation. Not far from London there might be the most enviable summer-resorts; on the Surrey land-hills, near *Leith Hill* and the *Ewhurst Windmill*, or on the *Hindhead* or the *Blackdown*, near *Haslemere*; or farther away, on *Dartmoor* or on the *South Downs*; but all these beautiful places offer no accommodation. *Ilkley Wells*, *Malvern*, and *Tunbridge Wells* are favourable exceptions as far as they go.]

¹ See p. 440.

² See p. 226.

yet the heat can be extremely oppressive. The accommodation and food are said to have improved. Reichenhall ought to be regarded as too lively a place for most cases of phthisis.

Badenweiler, in the Baden Black Forest, very beautifully situated at an elevation of 1,425 feet above the sea, is at the present time in vogue, owing to its good arrangements and to the constant care of the Government. The temperature is very equable, and west winds predominate. Residence there is agreeable and comfortable, the numerous visitors for the most part belonging to the better class of Germans, 27 per cent. being on an average foreigners. With regard to the thermal baths there, see page 181. Badenweiler.

Charlottenbrunn, 1,450 feet high, situated in the Silesian Reisingebirge, a mile from the station of Waldenburg, possesses an important whey-establishment, an iron-spring (0.2 of carbonate of oxide of iron), and an acidulated spring. Charlottenbrunn.

I have intentionally arranged the spas under consideration according to their height above the sea, in order now at a suitable place to mention a class of health-resorts which claim a special position for themselves, namely—

Elevated Health-resorts.

These health-resorts have recently attracted the most eager attention. Indubitable results, the genesis of which it was difficult to estimate, were accompanied by a rejoicing, which, promising unprecedented things, completely occupied the startled minds of practitioners, and in spite of some bad experiences in unsuitable cases indiscriminately sent to these health-resorts, still partially continue to occupy them. A more extensive consideration of this subject, which is still in suspense, is, therefore, necessary.

The main reason for the recommendation of almost all these places rested in their freedom from phthisis. I refer to page 503. We there proved that freedom from phthisical disposition is a peculiarity of race belonging

Streit-
berg.

Streitberg, 1,800 feet high, in Franconian Switzerland, situated in a beautiful and sheltered position, three-quarters of an hour from the station of Forchheim. Establishment for whey. Season from May to October.

Rippold-
sau.

Rippoldsau, 1,886 feet high, in the Baden Black Forest, is not badly situated, about three hours from the Hausach station. It possesses earthy-saline springs, besides milk and whey establishments. (Dr. Feyerlin.)¹

Aussee.

Aussee, 2,080 feet high, very beautifully situated on the Traun, in Styria, in a sheltered position on hilly ground. It is to be reached in a few hours from the Selzthal-Liezen or Ischl station, and it possesses a sool-bath as well as the new sanatorium of Dr. Schreiber, which combines a water-establishment with opportunity for the use of milk and whey. Season, from May 1 to October 1; May and September are the best months. The prevailing winds are south and west; in the summer months, however, a good deal of moisture falls. The disposition to hæmorrhage is, according to Schreiber, rather increased than diminished by a sojourn at Aussee. (Dr. Pohl.)²

Kainzen-
bad.

Kainzenbad, near Partenkirchen, 2,480 feet high, is to be reached in a few hours from the Weilheim station. It lies in a sheltered valley of the Bavarian Alps, at the foot of the Zugspitz. The air is moderately moist, soft, and free from dust; the temperature of the summer is remarkably equable; the greatest number of bright days occur in July and September (from the 13th to the 16th); the highest temperatures (24.5° and 23.3°) are in July, August, and September. The remedial resources, in addition to some alkaline and iron waters (the latter free from carbonic acid), are manifold—such as baths, douches, gymnastic implements, &c. The amusements are simple, but good and various. Season, May 1 to end of October. (Dr. Michaelis, of Dresden.)³

Eaux
Bonnes.

Eaux Bonnes, 2,512 feet high.⁴ The climate is rough, with great changes of temperature; the highest temperature, 33° Cent., 91.4° Fahr.; the lowest, 6 Cent. There is much rain in summer (33 days of rain in 75 days). The descriptions of the efficacy of the springs, which have

¹ See p. 468. ² See p. 224. ³ See p. 354. ⁴ See p. 280.

long been famous, correspond accurately with the descriptions which may be made of any highly situated health-resort of the first rank. In the *période apyrétique* of phthisis, special results have been obtained. (Drs. Leudet, Manes, Pidoux, Tarras.)

Mont Dore, in Auvergne. A spring, 42° C. (107·6° Fahr.) Mont Dore.
warm, with little carbonic acid, little carbonate of soda and common salt, the vapour of which is also used for inhalation, is much extolled, but the high situation of more than 3,300 feet is overlooked in the effect. Emaciated, broken-winded, and coughing horses are cured there; but this is the case also at the sulphur-baths of Cauterets, in the Pyrenees, which are at a similar elevation.¹

[*Le Prese*, about 3,000 feet above sea-level, in the beautiful valley of the Poschiavino, close to the Lake of Poschiavo, south of the Bernine Pass, has a mild climate, without excessive heat, 77° to 80° Fahr. being the maximum. The 'Kurhaus' offers good accommodation. Season, from June to September.] Le Prese.

Kreuth,² 2,911 feet high, is much frequented by South-German invalids suffering from chest diseases; it is rainy, but much sheltered from the wind. The accommodation and food are good. Kreuth.

Engelberg, in the canton Unterwalden, 3,180 feet high. It is to be recommended for the height of summer. The walks are free from dust, but shadeless. The air is still. There are twenty-two rainy days on an average in three summer months. Feverish patients, and those suffering from heart affections, find themselves worse there. Steamboat-station, Stanz, and then a four-hours' drive. (Drs. Cattani and Müller.) Engelberg.

Churwalden, 4,043 feet high, situated three hours from Chur (Coire), in a valley stretching from N.W. to S.E., with comparatively little rain and no great moisture. Season, June 1 to September 30. Churwalden.

Bormio, 4,460 feet high, to be reached in twenty-four hours from Innsbruck, by way of Bozen, Meran, and Stilfserjoch. In spite of its many advantages, it lies too far out of the world for invalids suffering from lung-affec- Bormio.

¹ See p. 281.

² See p. 223.

tions who come from the North. As a summer-resort for the visitors to Meran it claims some consideration, on account of its lime-thermæ, 30° R., and its high situation.

Davos am
Platz.

Davos am Platz, 4,805 feet high, situated in a broad valley of the Grisons, stretching from the NE. to the SW., and watered by lake and river, is to be reached in 6 or 7 hours from the Landquart station (on the rail from Zürich to Coire); it was the first health-resort which adopted Brehmer's cold-water system. Experience as to the salubrity of a sojourn there, and as to the superfluity of all treatment with medicaments (or rather of spontaneous cures of phthisis in natives returning from the lowlands), had, however, been long obtained. The summer at Davos is characterised by great windiness, constant sudden changes of temperature, and considerable falls of moisture. The winter is by far to be preferred in each of these respects; the wind is less, and the climate is more equable and dry. The transition period from summer to winter is November; the country is then generally covered with snow till April. During these 5 months (151 days) there are from 60 to 90 beautiful and clear days, in which the sick can sit out in the open air, although the thermometer in the shade shows a certain amount of cold, the morning minimum of which is 16° Cent. (4° Fahr.). January and February 1871 had 26 days in which sick persons could spend the whole day in the open air. At page 575 we stated that this is effected by the strongly radiating heat of the sun, which, passing through very dry air, is but slightly weakened. These beautiful and clear days are preluded by north-east wind. The Föhn, as every south wind is erroneously called in Northern Switzerland, is dreaded at Davos, on account of the sudden change of weather it produces. Davos, as the head of the Alpine health-resorts, with their heterogeneous effects, has experienced very opposite verdicts. Most of the doubts are a matter of mere theory. H. Reimer has latterly added personal invectives, and it is difficult to estimate the state of affairs. My own experience, embracing 5 years, and about 60 cases, has shown me that the results of Davos air and treatment are

best in sluggish constitutions, where the reaction is slow; that much-enfeebled persons should only be sent there in those cases in which the low condition of the functions of assimilation is the prominent evil, and there is no prospect of obtaining any improvement in lower regions; that the cessation of perspiration and fever in some cases is the merit of the treatment alone; that, lastly, the risk must be run of seeing many cases of phthisis on the point of improvement sink from acute illness, especially from pleuritis and pneumonia. This latter risk is decidedly greater in elevated mountains than in level country. A sojourn at Davos always acts as a powerful stimulant.

[My own experience is not quite in accordance with that of Dr. Rohden regarding this point. In a paper read before the Royal Medical and Chirurgical Society,¹ I was able to compare the experiences on five invalids who had spent one or several winters in the low as well as in elevated health-resorts, and the result was that they were much less confined to their beds by intercurrent acute diseases in the cold and elevated than in the warm and low-level health-resorts. I am now able to test this question on fifteen cases who have spent one or several winters at low as well as at elevated health-resorts. These 15 cases spent together, 212 months at low and warm, and 360 at elevated and cold places; they were confined to bed by intercurrent diseases (bronchitis, pneumonia, pleuritis, rheumatic fever, hæmoptysis, diarrhœa), during 58 months at the low and warm, and during 68 at the high and cold health-resorts, or, in other words, during 27·3 per cent. of their stay at the former, and during only 18·8 per cent. of their stay at the latter health-resorts. I do not intend to draw a decided inference from so limited a field of experience, but, as far as it goes, it is favourable to the high-level health-resorts. Possibly, however, this advantage does not so much depend on the climate as on other concomitant circumstances, such as the following.—1. In elevated regions, the cold and the snow induce invalids to dress more uniformly warm, and to be on the whole more on their guard, while in the warmer localities they

¹ Vol. lii. p. 235, 1869.

often are induced to go out in light coats, owing to the heat of the sun and the smiling green of the orange and lemon trees; they become hot from walking, and then are chilled on returning into the cold houses or shady streets. 2. In the Southern old-established health-resorts there are tempting parties and other amusements, which are rare in the higher regions. 3. In the warmer localities there is only imperfect medical superintendence; the invalids often live where they like and how they like, without asking their doctors; while in the higher regions, at all events, they are much more under medical supervision, though this might be still stricter than it is at present.]

Brehmer's objection to Davos, that it lies too near glaciers, is based on ignorance of the situation. The superintendence of the sick is likewise perfectly sufficient; the nursing of the sick is secured by deaconesses, the attention given to them in the chief houses is considered good, and the careless habits formerly tolerated, from too great confidence in the climate and too little in the treatment, now rarely occur. At any rate, Davos is a health-resort well worthy of attention, and in which medical science may rejoice, if the greater number will exercise a discriminative judgment with respect to suitable climates also in phthisis. The prices are not high, and the accommodation is sufficient and good. The visitors in winter amount to 200; in summer to 300. (Physicians, Drs. Spengler, Schimpff, and Unger.)

[*Davos* has made an almost incredible progress as a health-resort, especially for the treatment of consumptive diseases of the lungs, since I first directed the attention of the English profession to it in 1867.¹ At that time the place was almost unknown, and possessed only two small old country inns. When I visited it last autumn I found several large new hotels and boarding-houses specially arranged for the reception of consumptive patients during winter; and in addition to the establishment at *Davos am Platz*, *Davos Doifli*, about two English miles higher up in the valley, is also now provided with a large

Davos
Doifli.

¹ 'On the Influence of the Alpine Climate in Pulmonary Consumption,' *Brit. Med. Jour.*, vol. ii., 1867.

Hotel-Pension for consumptive invalids throughout the whole year, and has also the advantage of a resident physician (Dr. Volland). At Davos am Platz there are, moreover, five or six villas for families not wishing to reside in hotels.

[To convey some idea of the winter in the seregions, I will give a short abstract from letters by patients, and by Dr. Spengler, regarding the weather during the winter 1873 to 1874 at Davos and in the Upper Engadin. The snow began to remain permanently on the ground ('Einschneigung') in the middle of November; perfectly beautiful days—clear, warm, and still—from the end of November to Christmas; changeable, with clouds, snow, and wind, from Christmas till January 2; then again beautiful throughout the month, with only six bad days in January; February and March fine, with rare exceptions; snow began to melt in the middle of March. On almost two-thirds of the days patients were able to *sit* in the open air. This was, however, an unusually favourable winter, as it was also along the Riviera. The number of winter guests in the valley of Davos varied during the winter from 320 to 360. For further information regarding the climate, I may refer to Dr. Spengler's work on Davos as a health-resort in phthisis (Basel, Richter, 1869), and to Waters ('Winter in Hochgebirge,' Basel, 1871).]

The Spanish health-resort of *Panticosa*, situated about 5,000 feet high, on the southern declivity of the Pyrenees, a few miles from the French frontier, must be mentioned on account of its reputation in phthisis. Unfortunately, no exact indications are to be drawn from the statements. The very weak mineral spring, with its large amount of nitrogen gas, is taken in great quantities, and, on account of the high situation, this is done with impunity. Inhalations also play a part in the treatment.¹

The village of *Saint Moritz*, about 6,000 feet high,² is likewise a resort for phthical patients. The winter is very severe, though dry. The ground freezes five to six feet deep, so that the springs cease to flow. The snow disappears at the beginning of May. The arrangements are good.

¹ See p. 281

² See p. 473, for the springs.

[St. Moritz has a winter climate similar to that of Davos, though slightly colder, owing to its greater elevation; but the village of St. Moritz has the winter-sun rather longer than Davos. Our own experience with regard to the influence of the winter climate of St. Moritz on *suitable* cases of consumption is as satisfactory as that of any other place in Europe. The principal reason why it has not risen as a winter health-resort in the same manner as Davos is, that the people of the Upper Engadin do not seem particularly to court winter guests, partly because they are tired by the immense work of the summer, and partly because—as we know from personal intercourse—some influential persons seem to fear that the more gay summer guests would diminish in number if St. Moritz were to be resorted to by a large number of consumptive patients. We may refer, regarding some of our own cases, to a paper in the ‘*Medico-Chirurgical Transactions*,’ vol. liii., ‘On the treatment of phthisis by prolonged residence in elevated regions.’ If warm buildings were to be erected for the purpose, and if one or two physicians, Dr. Berry, of St. Moritz, included, were to devote their energy to this work, we have no doubt that as good results would be obtained at St. Moritz as at Davos.]

Sameden.

[*Sameden* is likewise well-adapted as an Alpine winter health-resort (Dr. Brugger). As summer health-resorts the beautiful villages *Pontresina* (Dr. Ludwig), *Camfer*, *Celerina*, *Silvaplana*, *Sils-Maria*, all provided with good inns, and situated about 6,000 feet above sea-level.]

[Switzerland possesses many other excellent summer residences for invalids, but most of them are less adapted to consumptive patients, partly on account of their more exposed position, partly on account of the absence of medical aid in the near neighbourhood. Such places are the hotels on the *Eggishorn*, and *Riffel*, above 7,000; on the *Bernine Pass*, the *Maloja*, the *Belalp*, and *Frohnalp*, above 6,000; *Rigi Scheideck*, *Mürren*, near *Lauterbrunnen*, and *San Bernardino*, above 5,000; *Zermatt*, *Rigi Kaltbad*, *Comballaz*, *Hotel Alpen Club*, in the *Maderanerthal*, and *Klosters*, in the *Prättigau*, all between 4,000 and 5,000; the *Stossberg Hotel*, the *Hotel Monte Gene-*

roso, *Beatenberg*, *Champéry*, between 3,000 and 4,000; *Gais*, *Seewis*, *Glion*, *Weissbad*, *Heiden*, *Sonnenberg* (near Lucerne), *Giessbach*, *Seelisberg*, *Hotel Axenstein*, between 2,000 and 3,000.

Amongst these health-resorts we beg to direct particular attention to two almost unknown localities, namely, the *Hotel Alpen Club*, in the *Maderanerthal*, about 4,200 feet above sea-level, near the St. Gotthardt road, which offers good accommodation, and is well sheltered by a pine forest, in the shade of which the invalid may enjoy the open air during the whole of a long summer's day without exposure to the sun; moreover, the scenery of the *Maderanerthal* belongs to the finest in the Alps. If there were a physician at the establishment, it would be specially adapted to consumptive people during summer and autumn. The other place is *Beatenberg*, about 3,700 feet above the Lake of Thun, in a sunny and tolerably sheltered situation, being free from fogs, enjoying a beautiful view over the lake, and possessing good opportunity for exercise.]

Of the elevated spas out of Europe, we may mention : In the Himalaya, *Dagshai*, 6,025 feet high; *Kassauli*, 6,650; and *Simla*, 7,156; the two former military sanatoriums, the latter a fashionable resort for the hot months; and in the Peruvian Andes, *Jauja*, a broad valley, lying at an elevation of from 10,000 to 11,000 feet. The atmosphere of the latter is characterised in a remarkable manner by a great deficiency of ozone. The physician there, Zapater, writes of cases which, having found evil results arising from Huancayo (which is richer in ozone, though otherwise similar in climate to Jauja), have at once experienced advantage from Jauja. Jauja is, however, a terrible place of residence. Its visitors amount to from 200 to 300, and the journey from the coast is very long.

Indian and
South
American
elevated
spas.

CHAPTER VII.

OFFICIAL CLIMATIC HEALTH-RESORTS.

AT page 531, we have already pointed out that all places prescribed for affections of the lungs accord with each other in the one point, namely, that they are air health-resorts. We only yielded to custom when we arranged the very various places according to those properties which have hitherto been considered as their most essential characteristics. We now, for the first time, come to a class which has always been understood to produce a salutary effect upon phthisis, owing to certain climatic peculiarities, and not from mineral waters, baths, or dietetic treatment. From the confusion of statements, however, which renders it difficult to estimate this class of health-resorts, their peculiarity as air health-resorts stands out as the one criterion that holds its ground—as places in which the sick person can give himself up to the enjoyment of fresh air, and can exercise in it with greater ease and comfort, than he can at home. That these official climatic health-resorts are principally *winter-resorts*, arises from the fact that they owe their origin to Northern races and opinions, which regard the native winter climate—and not the unwholesome mode of life resulting from it—as the cause of the non-improvement or increased progress of phthisical disease, and *for this reason* seek for places in which they do not find the disadvantages, both imagined and actual, of their Northern winter. *Unconscious of the cause*, they find improvement here and there from the positive beneficial properties of the new climate; but in by far the greater number of cases from more plentiful breathing and exercise in the open air, to which they imagine they may expose themselves without danger.

Valuation
of crite-
rions.

In addition, however, to this general characteristic as
air health-resorts, an accurate analysis has shown itself Analysis.
necessary, because the fact requires explanation why
certain cases found recovery or improvement only at
certain climatic resorts, and became worse, or even ended
fatally, at others. Former investigations were based on
the somewhat misty notions of an erethic and a torpid state
of phthisis; and these localities were accordingly quite
empirically classified as places with a sedative climate and
places with an irritative or stimulating climate—the former
adapted for erethic and the latter for torpid phthisis. This
division corresponds thoroughly with the state of the case,
only the classifiers, ignorant of their grounds, valued some
of the climatic influences too high and others again too low,
and excluded altogether those influences, such as the social
circumstances, food, and accommodation, which exercise, as
we have already shown, an important effect upon the pro-
gress of the cure. Hence originated also the recommenda-
tion of a great number of places, frequently only based on
their common situation in a certain vicinity, just as there
are even now adherents to the old routine who send their
patients ‘to the South.’ This great number became in
time diminished; many a place never practically acquired
the reputation of a health-resort; in others the indica-
tions of adaptability became better known, and the matter
stands at present thus—that we are satisfied with a
limited number of climatic resorts, and that these, with
comparatively few of an intermediate kind, are the main
representatives of the two old classes.

We base our division upon atmospheric moisture.
With regard to this it was stated, at page 535, that ‘the
equable temperature of an atmosphere depends principally
on its amount of water.’ Discussions as to the expressions
‘relative’ and ‘absolute’ moisture, which appear in cli-
matic tables, and which were mentioned at page 37 of this
work, are here out of place. In order to prevent misun-
derstandings, we will, however, remark that only very
conditionally are the amounts thus designated to be
applied to a climatic analysis as regards our valuation of
it, and that a great amount of relative moisture proves

nothing, unless the temperature on which it depends be given also. In my opinion, the instruments which showed these amounts ought to be replaced in pathological meteorology and climatology by those which give the loss of water in the organisms subjected to the climate—*i.e.* the thirstiness of the atmosphere—namely, the so-called evaporation-measurer, the atmometer.

Classifica-
tion.

This *division of climatic resorts*, according to the greater or lesser moisture of the air, and according to the consequent greater or lesser equability of the important atmospheric agents, coincides—a proof of its correctness—with the division into sedative and irritative climates. The moist, equable, and sedative places are those adapted for individuals suffering from still active phthisis; or, at any rate, requiring delicate treatment; the dry, unequable, and irritative places are those to be recommended for cases of stationary phthisis and vigorous constitutions. As places of *indifferent climate*, we shall lastly mention those resorts which, without any positive effective and prominent climatic feature, may be simply characterised as opportunities for living more comfortably and with more undisturbed attention to health than is possible at home.

This latter class encroaches upon the others, just as some places of the sedative class encroach upon the irritative, and *vice versâ*; and may even in certain cases, as health increases, be regarded as indifferent. In a high degree of relative health and vigour, almost all the climates mentioned are indifferent, owing to the elastic capability of equalisation possessed by such an extent of health. This is, however, lacking, as has been already often mentioned, in the sick, or at any rate the existing degree of this capability must be carefully estimated.

Differen-
tial the-
rapy.

In many cases, moreover, *the difference between the new conditions and the old* refers to the soil on which the case of illness in question has arisen, an element to be taken into consideration. Indeed, the extent of the effect produced by any therapeutic measure is always regulated by the extent of the difference between the new life and the former one. Thus, sea-air is a remedy to the inha-

bitant of inland places, producing often even violent effect, just as mountain-air is to the dwellers in the valley, and even the air of level lands to the mountaineer. This effect, whether praised or blamed, appears incredible and doubtful to one who dwells there, because he does not experience it in himself. In the same manner a climatic peculiarity loses in time its effect on the organism, which has meanwhile adapted itself to conditions formerly foreign to it; and thus well-chosen transition stations would render the striking difference less sudden.

All that has been already said in the fourth chapter with regard to the *general conditions* of health-resorts, must be borne in mind with respect to the climatic resorts to be presently mentioned, namely, that it is not any single thing which forms a health-resort, but the totality of those things important for the sick. If we are sanguine enough to presuppose that our patients will do nothing absolutely injurious to health, there lies, nevertheless, a matter for important consideration in the strangeness of the new place and of the new and unavoidable mode of life. And if there be no objection to be raised on the part of the body, an indication *pro* or *contra* may possibly be furnished on the part of the mind. The discomfort of body and mind which seizes the weak and enfeebled when he has to deal with absolutely strange surroundings, with food of an unknown kind, with customs which jar against him because he is not brought up in them, with a foreign, perhaps unsympathetic language, and thus with matters generally which call for an effort on his part, is an influence producing many evil results. Suitable companions acquainted with the country may compensate for this unpleasantness, which is injurious to the sick person when travelling alone, and in some cases may even transform it into a beneficial excitement. The cases are but rare in which life and travel alone are of advantage to the sick person, and as exceptions they do not affect the rule to be observed by the physician, namely, that he should allow a sick person a longer stay in a foreign land only when attended by companions judiciously chosen. This requirement amounts to absolute necessity when no gua-

General
conditions.

rantee is afforded on the part of a sick person for a strictly healthful life. Only those acquainted with Southern health-resorts by personal experience know what incredible habits are often pursued by the sick residing there. Gaming, drink, and sexual excesses often ruin in these places in a short time the results of many months of care at home, whilst the independent connection between the sick person and the physician is not capable of affording the necessary protection against these errors and numerous others of a lesser kind, but always best avoided. Lastly, sick persons requiring especially careful nurture should only be sent to remote foreign health-resorts in those rare cases in which the question of recovery plays no part, and the transmission of comfortable domestic conditions to a foreign land is practicable.

Definition.

As the result of all these considerations, we obtain the following definition. *A good climatic resort is a locality which, in addition to other good properties, is so climatically constituted that a sick person may have his condition cured or improved there, under suitable treatment, with greater certainty, rapidity, and ease than at home.* Whoever recalls to mind what has been said in former chapters with regard to the slight value of higher temperatures and the great value of good modes of treatment, will be able to perceive the impartiality of judgment which is required by the physician with respect to many alluring peculiarities in the places to be mentioned.

Fashion in therapy.

One of the most alluring is *fashion*, which, changing about every ten years, sometimes patronises one and sometimes another winter-resort, crowding it with indiscriminate sick persons. The place that has come into fashion with one nation may not be equally well suited for another. *Every nation has its average constitution*, and this is, indeed, all the more diverse from that of other nations, the more diverse are the climatic, alimentary, and social conditions under which it has lived. On the South coast of England the author within a few weeks got rid of a catarrh, which a year and a quarter, two months of which had been spent in South Italy, had not been able to cure.

A.—MOIST HEALTH-RESORTS OF EQUABLE TEMPERATURE.

These are, on an average, suited to cases of active phthisis with tendency to pyrexia and hæmorrhage, and still complicated by the presence of caseous deposits. The fever is generally moderated in a short time, and frequently disappears entirely; the hæmorrhage ceases, except when existing deposits soften too rapidly before the vessels in the vicinity are obliterated. At the same time improved nutrition occurs, accompanied with quiet sleep. In advanced cases, it must be admitted, a slight appearance of catarrh of the stomach is manifested, succeeded by softening and ulceration of the follicles infiltrated with cheesy matter, and consequent acceleration of the fatal termination. The general characteristic of these spas is equableness and an absence of irritation in those influences that principally concern the sick. It might be a question whether the repose or tediousness of the whole life at these spas ought not to be taken into consideration as a powerful influence, if Pau and Venice did not almost assert the contrary. That the solitariness of Madeira, the absence of the rattle of carriages at Venice, and the tedium of Pisa, form an important element in estimating their value, ought, however, to be emphatically insisted upon.

Equable
and calm-
ing atmos-
pheres and
conditions.

Madeira, or rather Funchal, in Madeira, is of essential use in cases requiring very careful management at the commencement of the malady, but also when considerable changes of a quiescent nature have taken place, if the sick person spend at least several years in the island. The winter is some degrees warmer than the North German summer, but without the great changes of temperature characteristic of the latter; and the summer is not hot. Equable and not inconsiderable moisture, though with few days of rain, renders the climate very soft and agreeable. Vigorous constitutions speedily feel themselves, however, unpleasantly enervated, both mentally and physically; the functions of digestion refuse their office; and it becomes necessary to quit the island. In an average winter temperature of $+13.6^{\circ}$ R. (about 62.5

Madeira.

Fahr.) the minimum of the night is $+ 7.4^{\circ}$ (about 48.7° Fahr.), and the highest degree of heat in summer is $+ 25.5^{\circ}$ (about 89.4° Fahr.). The temperature of the sea-water even in winter is $+ 13$ to 18° R. (61° to 72.5° Fahr.). The voyage is made from Liverpool three times monthly, by the African mail-steamer, for 17*l.* 10*s.* and 13*l.* 5*s.* sterling. Other steamers go from Southampton four times monthly for the same price. At Madeira itself the expenses monthly are at least 15*l.* Medical practice is in the hands of Portuguese and English, but a few sick German physicians also reside at Funchal.

[We have seen much good in some cases of emphysema and asthma, and I scarcely think Madeira sufficiently appreciated in these conditions; while it has been on the one hand too much extolled, on the other too much condemned, in the different stages of phthisis. Cases which may be called constitutional phthisis, *i.e.* those with a *strong* hereditary element, are least benefited. Drs. Grabham and Goldschmidt.]

Azores.

[The *Azores* have a similar climate to that of Madeira, but the absence of proper medical aid is a serious drawback.]

West Indian Islands.

[The *West Indian Islands*, though enjoying a high winter temperature, are subject to violent winds and to frequent changes; they are not suited for active cases.]

Pau.

Pau, chief town of the Basses Pyrénées, situated on a plateau 650 feet above the sea, is a health-resort of importance, possessing comforts of every kind for visitors, and beautiful promenades. The average winter temperature is 5.6° R. (44.6° Fahr.). There are 24 days on an average with cold below freezing-point. The greatest amount of cold has been $- 9.6^{\circ}$ R. (10.4° Fahr.); but this is of rare occurrence. There are on an average 140 rainy days, but for the most part they have sunshine for some hours. The air is moist, a calm generally prevails, but it is frequently agreeably interrupted. In most respects *Pau* is one of the best climates for those suffering from chest diseases, and among its local advantages is the shorter journey it entails. Physician, Dr. Lahillonne. [Drs. Bagnell, May, Stewart, and Sir Alexander Taylor.]

Pisa, in the valley of the Arno, with 50,000 inhabitants, has a winter temperature only about 3° Fahr. higher than Pau, but a much moister atmosphere, more days of rain, and tolerably constant cooling sea-winds; the river is occasionally frozen over for some time. The bright days in the eight season months amount at the utmost to 124, and at the lowest calculation to 87. According to Bröking, 62 rainy days and one snowy day occur on an average in the five winter months. There is most rain in November, and least in April. The accommodation and food in the hotels are good, and there are no boarding-houses. Rate of expenses moderate. The town is desolate, and life in it tedious. Dr. Bröking, of Soden. Pisa.

Venice.—Moist air, but much sunshine; pleasant life in the quiet enjoyment of the peculiar town and of its agreeable inhabitants is the advantage afforded by Venice, but this is counteracted by the uniformity and everlasting level of its walks, its bad water, and abundant rain. January and February are the best months, but the winters vary considerably, and hence very different opinions are formed concerning them. Careful management of the sick is of the utmost importance at Venice. Venice.

Rome can scarcely be classed amongst the health-resorts for really consumptive invalids, owing to its frequent alternations from the hot and damp Sirocco to the cold and dry Tramontana; and the attractions of history and art form another source of danger, but this latter element furnishes to another and large class of invalids requiring change of climate and occupation great advantages, and to them the changeable nature of the winter and spring temperature affords a kind of stimulus. (Drs. Aitken, Camerer, Deakin, Erhardt, Pantaleoni, Small, Taussig, Valentiner, and others.)

Ajaccio, in Corsica, possesses very favourable climatic conditions. The prevailing wind is the moisture-laden and warm south-west; the north winds are successfully kept off by the mountain-chain, 8,000 feet in height, running through the island, branches of which surround the town. The psychrometer places Ajaccio next in rank to Venice, whilst the temperature surpasses that of the Ajaccio.

Riviera in height and equability. At the end of November 1868 I observed in the morning at seven o'clock, at noon at one o'clock, and at night at eleven o'clock, the same height of thermometer of 11° to 12° R. (56.75° to 59° Fahr.) The rainy days are few, and the annual amount of rain comparatively small (623 millimeters = 24.5 inches). The country scenery is wonderfully beautiful, and is easily reached; and the expenses of living have been hitherto still lower than in the Riviera. The town is dirty and tedious. Private dwelling-houses are dear, but there are a few not bad hotels. The communication with the Continent by way of Marseilles is miserable. It is to be hoped that in a few years Ajaccio may rise to the high standard of excellence to which its climate entitles it. (Dr. Zavory, of Gleichenberg.)

[Although the summer and autumn would be too hot, and perhaps not quite free from malaria, the mountains would probably afford good summer quarters. Dr. Battersby, Sen., is at present practising at Ajaccio.]

Algiers.

Algiers.—'Winds from the north blow here almost during the entire year, whilst it has been proved that south winds prevail only for about 30 days. For 344 days therefore a moist sea-wind blows at Algiers, and this moistness of the atmosphere manifests itself in plentiful deposits, taking the form of abundant rain during the winter and as strong dew in the summer. The monthly temperature is a third higher than in the Riviera (Menton), on account of the warmer nights.' (Bennet, 1870.) Other writers express themselves more unfavourably; variations of heat during the day, and the difference between sun and shade, are especially mentioned as frequent and considerable. The expenses of living are rather high. The voyage from Marseilles occupies two days. We, therefore, rank Algiers with a certain reserve among places of equable climate, especially as warnings have been recently given against its recommendation for irritable, full-blooded, and feverish patients. [Drs. Bruch and Gentle.]

[Dr. Walshe mentions the islands of *Corfu* and *Zante* as not favourable to the treatment of consumptive invalids requiring care.]

The *places of resort on the English Southern coast* English South coast. have been hitherto remarkably neglected in Germany. Their climatic conditions raise some of these to the rank of health-resorts of the highest excellence in cases of phthisis, which require careful management, although the great number of rainy days (105) and the frequent cloudy sky essentially diminish the agreeableness of residence in them. The average winter temperatures are nearly equal with those of Venice, Pisa, and Pau, whilst, it is true, minima occur, though rarely, which are only attained by Pau. The mortality in all is but slight; this in a great measure arises from the equableness of the climate, combined with many excellent hygienic arrangements. The air in all these places is sea-air of remarkable softness, because it is principally brought by the south-west winds. The only irrefutably great evil of these health-resorts for Germans is the exclusively English mode of life that prevails at them. This, without question, contra-indicates their use as regards most of our patients (*i.e.* Germans). Moreover, a certain amount of wealth is a *conditio sine quâ non*, as are lastly, also, a knowledge of the language and a predilection for English customs.

[*Torquay*, in Devon, has a beautiful situation, being Torquay. built on the terraces of three elevations and in the intervening valleys, and thus allowing a considerable choice according to the degree of protection and other climatic conditions required by the invalid. The climate is remarkably equable, being several degrees warmer in winter, and cooler in summer than London, the mean temperature being between 44° and 46° Fahr. It is tolerably well protected from east winds, although in spring their influence is not altogether to be avoided. The great number of cloudy days compared with Pisa and Pau, which are otherwise somewhat analogous, is a decided disadvantage; while the home comforts, the better hygienic conditions, and the shorter journey ought to be taken into consideration in the selection of a winter climate for an invalid.¹

[*Sidmouth*, though comparatively little visited by in- Sidmouth. valids, deserves to be more prominently mentioned on

¹ See Dr. Radclyffe Hall's work on *Torquay in its Medical Aspects*.

account of its very sheltered position, being open almost only to the south. The semicircle of cliffs which form this protection is very fine. We can see no reason why Sidmouth, if it were provided with grander hotels, with villas, and with better railway accommodation, should not occupy a high position amongst the winter health resorts of England.¹

Dawlish. [*Dawlish* is considered to be as warm as Torquay, but it is less sheltered from east wind, and, therefore, less adapted in spring for delicate patients.

Salcombe. [*Salcombe*, as Sir James Clark has already mentioned, would be a good place, if the sheltered ground for exercise were not so limited. The fact that orange and lemon trees thrive almost unprotected in the open air can scarcely counterbalance this disadvantage. The same may be said of *Salterton*, near Exmouth.

Penzance. [*Penzance*, on the Cornwall coast, has a somewhat more humid climate than the localities just mentioned on the South coast of Devon, and is slightly warmer in winter and cooler in summer; the sea-breezes are remarkably pure and strong; but for delicate consumptive invalids the wind is generally too high, as to them any violent wind, even a warm south-west, is a source of irritation, and there is no protection from these winds. To less delicate invalids, however, requiring a pure, humid, equable air, Penzance and some of the adjacent localities are very advantageous.

Cove. [*Cove*, near Queenstown, in Ireland, is built on terraces, and offers good accommodation to invalids, and opportunity for out-door exercise. The winter and spring temperatures are only slightly inferior to those of Penzance, and somewhat higher than those of Torquay. The protection from wind is satisfactory. The number of rainy days is described as about the same as on the South-east coast of England.

Channel Islands. [The *Channel Islands*, especially *Jersey*, with *St. Aubin* and *St. Helier's*, have a high winter temperature and pure air, but are windy, like Penzance; and, on the whole, the remarks on the latter place are applicable to Jersey. The rather long sea-passage is a drawback to

¹ See Dr. Ingleby Mackenzie's papers on the 'Climate of Sidmouth.'

some persons, but the expenses of living are somewhat less than at Penzance.

[The *West Coast of Scotland* is much neglected, though it offers some considerable climatic advantages, especially the island of *Bute*, with good quarters in its capital, *Rothsay*. According to Sir James Clark's tables, the mean temperature of the year is 41.25° Fahr.; the mean for winter, 39.62° ; spring, 46.66° ; summer, 58.2° ; autumn, 48.59° Fahr. The climate may be characterised as rather humid, but mild and equable, similar to the South-west coast of England, but about 2° Fahr. colder. It is tolerably well protected from the east winds, and offers ample opportunity for outdoor exercise.

Bute and
Rothsay.

[Here the *Orkney* and *Shetland Islands* might be mentioned, but as long as they offer no attractive accommodation, they cannot be generally used.

[As an *intermediate group* of health-resorts between the moist health-resorts just mentioned and the drier localities in the following group, we may consider some other English health-resorts.

Interme-
diate
group.

[*Bournemouth*, at the mouth of the Bourne, on the Hampshire coast, offers advantages to the consumptive invalid unsurpassed by any other place in England. The valley of the Bourne stretches from the broad bay some miles inland, and is bounded by fir-clad hills on the north-west, north, and north-east. The villas inhabited by the invalids are built on the slopes of these hills, and are protected partly by the formation and position of the hills from the north-east, north and north-west partly by the fir trees. The east winds of spring find their way to some degree into the valley, but not quite so much as at Hastings and some other climatic resorts of England. The porous sandy soil is a great advantage. By its absorbing powers it not only renders the air less damp, but allows outdoor exercise almost immediately after a heavy shower. Moreover, there is, according to Dr. Falls' observations, decidedly less rain at Bournemouth than at Torquay, owing to the conformation of the surrounding country. The mean temperature of the regular season, from October to March, is between

Bourne-
mouth.

44° and 46° Fahr., the diurnal range about 13°, the humidity about 83°, and the rainfall slightly above 17 inches.

It is an important matter to take care that with the growth of Bournemouth the fir-trees are saved; and increased hotel-accommodation is much to be desired.

Arcachon.

[*Arcachon*, about 32 miles from Bordeaux, near the Bay of Biscay, with which it communicates by a narrow channel. Hills covered with pine-forests surround a kind of half-inland bay, and chalets for the reception of the invalids are erected on the slopes of these hills, formed of sand and sandstone. The force of winds, especially the west winds, is broken to a great degree by the pine-forests; there is much rain, and the air is rather moist, though the soil is dry, owing to its great porosity. The chalets are complained of as being badly built. The emanations from the pine-trees are on some days very marked, and some of the good effects are ascribed to this element, which is more prominent at Arcachon than at our Bournemouth, with which the former is often compared.¹

**Hastings
and St.
Leonard's-
on-Sea.**

[*Hastings* and *St. Leonard's-on-Sea*, on the Sussex coast, are protected from the north and from the north-east winds, but partly exposed to the east, and entirely so to south-eastern and south-western gales. These places combine, with their excellent accommodation, and their short distance from London, in autumn and in the first part of winter, the advantage of many sunny days and tolerable freedom from fogs; but delicate consumptive invalids ought to leave before the commencement of the east winds—therefore, in the beginning of February.

**Ventnor,
Bonchurch,
and
Undercliff.**

[*Ventnor*, *Bonchurch*, and the *Undercliff*, in the Isle of Wight, about 150 feet above sea-level, are sunny and cheerful, well-protected from north, north-west, and north-east winds, but rather exposed to south-east, south, and partly south-west. According to Sir James Clark's tables the average winter temperature is 41·89°, or rather more than 2° lower than that of Torquay—spring 49·66°, summer 60·63°, autumn 53·58° Fahr.; mean daily range in winter 7·71°, in spring 12·55 Fahr.

¹ See Dr. Hameau, *Le Climat d'Arcachon*.

[The new and well-arranged hospital for consumption, due principally to the exertions of Dr. Hill Hassall, will in time furnish material for the appreciation of the influence of the climate of Ventnor on phthisis.

[*Clifton*, near Bristol, in Gloucestershire, is built in terraces on the southern declivity of a hill of carboniferous limestone and hard sandstone. The soil rapidly becomes dry, and the air appears to be less humid than on the South Devon and Cornwall coasts, and the fall of rain seems to be likewise less. The winter temperature is about 3° cooler than at Torquay. In spring the place is less exposed to the influence of east winds than almost any other part of England. There is a considerable difference in the protection afforded in different parts of the town, the houses in the neighbourhood of the *Bristol Hot Wells*, near the bottom of the hill, being most sheltered. There is good ground for exercise, and the surrounding country is very attractive.

[*Grange*, a beautiful spot on the Morecambe Bay, in Lancashire, is well sheltered from the north and east, and shows by its vegetation the mild character of the climate, which in spring is probably preferable to most localities on the South and South-west coasts.]

B.—DRIER HEALTH-RESORTS, CHARACTERISED BY INEQUALITY OF IMPORTANT ATMOSPHERIC INFLUENCES.

Moisture on an average is at a lower amount and more variable. Changes of temperature are frequent, the difference between sun and shade often very great. The formation of dust is favoured by the dryness. Very clear air and few rainy days; therefore, agreeable places of residence. This causes a great conflux of visitors, with its consequences, such as amusements of various kinds, but these produce unrest and high prices. All this, together, has an undeniably exciting effect, rather pernicious in active cases of consumption, but harmless or even advantageous in stationary cases.

Unequable and exciting atmospheres and conditions.

Cairo, like Madeira, knows no winter in our sense of the term. The average winter temperature is some degrees lower than at Madeira, 11.7° R. (58.3° Fahr.);

Cairo.

the variations are greater, and the lowest degree of heat is 2.5° R. (37.6° Fabr.); the summer is insufferably hot, the air very dry, and the winds from the desert bring plenty of dust with them. (New observations appear necessary, as the more than 4 millions of trees planted by Mehemet Ali in Lower Egypt exercise already, according to G. Rohlfs, a considerable influence upon the climate. In the winter of 1867-68 such great rain occurred, that many houses in Cairo were ruined.) The expenses of living are great, and comfort is rare. The summer begins early in May. Many sick persons journey on the Nile in boats, but it is very expensive. Cairo has been for some time much frequented by persons suffering from chest-affections, and well-ascertained cases of healed cavities in the lungs, in not very excitable constitutions, speak in favour of it. Unfortunately the sick are obliged to leave not only the place, but the country itself in summer; and the treatment generally presupposes great pecuniary resources, attendants upon the sick persons, and altogether a condition which would not be compatible with the most primitive and heterogeneous state of things. While the voyage to Madeira can be undertaken at any time, Cairo cannot be visited before October, and must be left at the end of April.

[Exceptionally bad winters occur occasionally, though more rarely, also in Egypt; thus the winter and spring of 1873 to 1874 were cold and windy, and the complaints from invalids were numerous; while the South of France, the North of Italy, and above all the high Alps, enjoyed the finest weather, and the English coast was likewise satisfactory. (Drs. Grant and Reil.)]

Provence
and
Riviera di
Ponente.

The health-resorts of Provence and of the Riviera di Ponente have much in common. Situated on the southern declivity of the Maritime Alps or their branches, they are, with the exception of Hyères, actually sheltered from the north, and are exposed to the sun and the south wind. Some of them have an advantage from being situated in bays, or from being sheltered on other sides by mountain projections. These advantages of situation produce a higher temperature than that of the adjacent places; even

lemon trees and palms appear, therefore, in the most favoured situations. The temperature rarely falls below zero. The moisture of the air is strikingly little influenced by the immediate vicinity of the sea, as land-winds generally prevail; it varies, therefore, between great extremes (at Nice 15 and 90°, at Mentone 16 and 96°); the generally rare fall of rain causes dust, owing to the constitution of the soil (principally lime), which in windy places, such as Hyères and Nice, is a terrible torment to the sick. Most of the places are old colonies of foreign invalids, much frequented; and therefore, so far as is possible in the South of France and Italy, the dwellings are comfortable, the food and attendance good, and medical assistance ready and sufficient. Everything, however, depends on a certain amount of opulence. Opportunities for amusement abound—far too much so for those seriously ill.

Hyères, 1 hour from the sea, 5 English miles from the railway, with 10,800 inhabitants, is admirably situated, bright and sunny, but characterised by very great variability of the climatic elements. Dryness predominates occasionally for weeks, being caused by the violent mistral which blows for 60 days in the year; 56 bright days are estimated on an average during the winter. In exceptional years very low conditions of the thermometer occur, even to -11° Cent. (12.2° Fahr). (Drs. Chassinat, Duncan, Griffith, Laure, Lord, and Vérignon.) Hyères.

[An admirable little place, a few miles nearer the sea, is *Costebelle*, more sheltered, milder, and more humid, but rather distant from English medical aid.]

Cannes, starting from Marseilles, is a few stations before Nice; it contains 8,000 inhabitants, and from 2,000 to 3,000 visitors; comfortable villas and hotels abound; and the situation is wonderfully beautiful, being surrounded by pine forests. As at Nice, there is here also opportunity for sea-bathing. Cannes.

[Cannes, on the magnificent Bay of Napoule, is one of the brightest spots in Europe. It faces the south, but is somewhat protected from the south winds by the Lérins islands, from the east by the Cape de la Croisette, from the west by the Estrelles, and from the north by the main subal-

pine mountain range; perfect shelter, however, does not exist, and the *mistral* especially sweeps in February and March along and around the picturesque wall of the Estrelles, and its irritating qualities become all the more dangerous, the more the deep blue sky and the warm sun invite for long walks and drives, perhaps in thinner clothes. From the carefully weighed evidence of Dr. Frank, however, we know that with judicious attention consumptive invalids, if not too far advanced, may derive, and have often derived, from several winters at Cannes great benefit and permanent cure. They may enjoy the open air during a great part of most days, especially if they make good use of the numerous little woods and clusters of pine-trees; but they must avoid fatiguing walks, long drives, parties, and churches, for to these abounding sources of danger most of the incidental acute attacks or exacerbations, and most of the ill results are due, as well at Cannes as at other places of the sunny Riviera. The bay of Cannes is divided into a *western* and an *eastern portion*; the *western*, though more attractive by its natural beauties and numerous fine villas and gardens, is less sheltered than the *eastern* portion; and in the latter, again, the houses higher up in the valley of *Le Cannet* are the best for invalids requiring protection from wind, and from the exciting influence of the sea-air. *Le Cannet* itself, about two miles distant from the shore of Cannes, is as yet little used for invalids, but it offers very great advantages by the sheltered position and the distance from the sea. (Drs. Battersby, Frank, Dickinson, Marcet, Whiteley, Grossmann, and some well-known French physicians.)]

Le Cannet.

Nice, the capital of a department, containing 55,000 inhabitants, an intricate and partially beautiful town, is divided by the physicians of the place into several quarters; according to the position near or far from the watered valleys finding their way through the protecting rampart of the mountain, differences arise, the reality of which is rendered apparent by the fact that cold is much sooner taken in one quarter than in another. November and December are the mildest winter months; the most

Nice.

frequent winds in winter are the NE. and NW., and 'in general the air is greatly agitated, and a perfectly still atmosphere only occurs for a few hours occasionally.' (Sigmund.) It is a more reasonable place to live in than Mentone, as the choice is greater, but it has become likewise dear.

[The neighbourhood of the *Promenade des Anglais* is the most exposed and at the same time the most dusty part, to be altogether avoided by the consumptive invalid; the *Carabacel* is much better, but the only locality adapted to the treatment of phthisis is the suburb of *Cimiez*, situated rather less than three English miles from Nice. It is situated at a moderate elevation, which is to a great degree sheltered from the wind by the configuration of the neighbourhood, and where the invalid has additional shelter through the numerous olive trees. The climate of *Cimiez* is, indeed, altogether different from that of the *Promenade Anglaise* and the neighbourhood, and we know of excellent results obtained there in persons who could not stand Nice proper. Not only the wind, but also the dust, the glare and noise of the sea, and the social temptations, are much less felt. The *south* and *west* slopes of the hill ought to be selected. (Drs. Crossby, Drummond, Gurney, Lippert, and Zurcher.)]

Mentone, with 5,000 inhabitants, is the second railway-station from Nice, in contrast with which the lovely place stands out advantageously as a beautiful country residence compared with a dusty capital. For some years *Mentone* has been in fashion, and prices have rapidly regulated themselves accordingly. *Mentone* seems to be almost the warmest Riviera resort, and (with the exception perhaps of San Remo) it is the least dry. Mentone.

[*Mentone* is the most sheltered health-resort of the Riviera, especially the eastern bay, though also the western is very good, especially the villas somewhat removed from the sea. The excellent works of Bennet and of Siordet have rendered *Mentone* a household word with the profession of England and America. (Drs. Bennet, Marriott, Siordet, and several French and German physicians.)]

San Remo. *San Remo*, an Italian station on the Genoa and Marseilles Railway, has recently risen rapidly into fashion. The position is very sheltered, in a crescent-shaped bay; otherwise it presents but little difference from Mentone. The visitors were too numerous during the last winter, in spite of various new buildings. Prices for this season are high; boarding on an average 10 fr. A large sanatorium is in course of construction. There is a lack at present of sufficient promenades. [Drs. Daubeny, Freeman, Whitley]; Drs. Biermann, Blumenthal, Loewy, and Straehler.

[*Pegli*, near Genoa, is a quiet, sheltered place, with a good hotel, but otherwise not sufficiently arranged to be generally recommended to invalids requiring careful treatment.]

[*Nervi*, about six miles SE. of Genoa, on the slope of Mount Mora, is tolerably well-sheltered from cold winds, and promises to become a good winter station. At present there is not much comfort for English patients, excepting at one or two hotels and pensions. Dr. Millingen, of Genoa, practises, we are informed, during the winter at Nervi.

[*Spezia*, about 50 miles ESE. of Genoa, at the magnificent gulf of the same name, deserves likewise the attention of the profession as a place of the future.

[*Naples*, though it has advantages as a health-resort for other classes of invalids, does not claim our attention as a locality adapted to the treatment of phthisis.]

The *health-resorts in Sicily* have generally speaking a somewhat higher temperature than those just discussed, but their position is not so sheltered as those of the Riviera, whence they are occasionally exposed to great wind and dust. In the winter months there are frequent storms, especially in March. The temperature falls very rarely below zero. Stoves are not necessary, if the situation be good; but good dwelling-houses are rare, and the prices are high.

Palermo.

Palermo, a large city, with many comforts, good hotels, but unsuitable food, beautiful gardens by the sea, and situated in an interesting but still insecure vicinity.

The absolute differences of atmospheric moisture are very great (22 and 29), owing to the nearness of Africa, which now and then sends its desert-wind across, making the thermometer rise and the hygrometer fall, while the air is darkened with grey sand-dust. The number of rainy days in the winter is about 40, and they are tolerably equally divided through the months. The winter is the most equable season of the year. Palermo is reached by steamer from Naples. Drs. Berlin and Ohlsen.

[Palermo might be classed with group A, in moist and equable health-resorts, with regard to moisture of atmosphere; but the prevalence of high winds, especially north and north-west, does not allow us to regard Palermo as suitable for consumptive patients requiring careful management; on the other hand, we have seen cases of a more stationary character passing on to quiescence or relative cure under the influence of the climate of Palermo, during two or more winters.]

Catania, with not unfavourable conditions of climate Catania. and few rainy days, is situated on the black lava of Etna, and is itself built of lava, and is grey and dirty. For the present, the sick can only reside in the excellent Grande Albergo di Catania, where there is also usually a German physician. The walks are limited. Catania is reached by railway from Messina.

Meran, in the Tyrol, 3 hours' journey from the Bozen Meran. station, a small town, in the midst of magnificent scenery, is almost entirely sheltered from the wind; the south wind alone finds entrance, but this often rages terribly. Situated 900 feet above the sea, it has a dry atmosphere and little rain. It is a winter-resort only so far as the able physicians there (Tappeiner and Haussmann) have matured a mode of treatment, which allows the sick to spend the dry and clear winter there with advantage, in spite of the severe cold. Nowhere do we find more anxious invalids, more carefully regulated habits of life, and more elaborate method of feeding, than there; in addition to this, the uniformity and local restrictions of the life combine to render Meran a health-resort, which

practically demonstrates every winter that heat is in many cases of phthisis an unnecessary element, but that mode of life and medical treatment are the principal matters. At the end of February the transition to spring begins, and this dangerous period is for the most part spent further southwards. The spring season (April 1 to June 15), with its whey, goat's milk, herb decoctions, and baths—the latter are for the present indifferently provided—numbers very warm days, and is constantly found disadvantageous. The summer may be spent in the cooler and higher situations in the vicinity, such as Eggerhof, 3,500 feet high; Josefsberg, 1,800 feet high; and Lebenberg 2,000. The autumn season (September 1 to November 1) affords hard-skinned but very sweet grapes, which phthisical persons can only bear in daily quantities of $1\frac{1}{2}$ pounds, and which are better dispensed with. More than three pounds produce dyspepsia, diarrhœa, and an increased irritation to cough. At the beginning of the grape-cure, congestion and acceleration of the pulse are constant symptoms. No one suffering from chest-disease should be sent to Meran before the 15th of September.

Drs. R. Haussmann, Kleinhans, Pircher, and Tappeiner.

Bozen and
Gries.

Bozen and *Gries*, the former the principal station on the railway to Italy, containing 10,000 inhabitants, the latter a village near the town, are climatically similar to Meran, and are to be preferred in some cases, for Bozen affords more opportunity for avoiding the *ennui* and provincial uniformity of spa-life that characterise Meran. The shelter of the mountains is still more apparent at Gries than at Meran; Bozen lies in a somewhat less-sheltered situation. The neighbourhood of the latter is preferred by many to that of Meran.

Arco.

Arco, three-quarters of an hour from Riva, on Lake Garda, and two hours' journey distant from the Mori station, is situated near the Austrian frontier, 288 feet above the sea, and is climatically a dangerous rival of Meran. The average heat and the absolute maxima of heat are essentially higher than at Meran (a proof of this

is afforded by the numerous old olive plantations); the stillness of the atmosphere and the number of bright days in the three winter months are at any rate equally great. There are a great variety of walks, and these especially are deficient at Meran and in the Riviera, with their circumscribing barriers. The accommodation is still limited. The inhabitants, who speak Italian, are pleasant and ready to make advances. In every respect Arco may be regarded as a pleasant residence, in the midst of grand mountain scenery, for convalescents and for cases of stationary phthisis. Season, October 1 to May 1. (Dr. Bukeisen.)

[For most valuable and more detailed information on the health-resorts of the South of France and Italy, we may refer to the works of Sir Alex. Taylor, Dr. Henry Bennet, Dr. King Chambers, Dr. Theodore Williams, and Dr. Siordet.]

Lugano (about 900 feet above sea-level on the well-known lake of the same name), a handsome town, in the Tessin canton, with slight moisture of atmosphere and but a small number of gloomy days, at the same time possessing a comparatively quiet atmosphere. The environs are beautiful, and the Hotel du Parc good. It is a good transition station to and from the Italian health-resorts, especially in April and October. It is reached from Coire over the Bernardino pass in 21 hours' posting, and from Milan by a short route through Camerlata. (Drs. Carli, Galli, and Leoni.) Lugano,

[Near the lakes of Upper Italy there are several other places which may be recommended as transition-stages, either in spring on the way home or to the mountains from the winter in Italy, or in autumn on the way to Italy or the Riviera health-resorts, or to Egypt for those coming from the North, or from the summer health-resorts in the Alps. These localities are also suitable to those spending the winter and summer in the Alps, but wishing to escape the transition-period from autumn to winter and the melting of the snow in spring.

[*Pallanza*, about 600 feet above sea-level, on the Lago Maggiore, almost opposite the Isola Bella, deserves most Pallanza,

attention amongst these localities, not only on account of the natural climate, but also on account of the arrangements at the hotel, which are specially adapted to the condition of invalids during winter. (Resident physician during the winter months, Dr. Scharnbreich.)

[*Stresa*, near *Pallanza*, though less adapted to the invalid, may likewise serve as a transition health-resort.

[The same may be said of *Cadenabbia*; of the beautifully situated *Villa Serbelloni* (about 700 feet above sea-level), near *Bellagio*, on the Lake of Como; of the *Villa d'Este*, near Como; of *Chiavenna*, on the Italian side of the road over the San Bernardino and the Maloja; of *Bez*, in the Rhone valley; of *Gersau* and *Vitznau*, on the Lake of Lucerne.]

C. INDIFFERENT HEALTH-RESORTS.

The following places may be thus designated, in so far as they do not especially differ either in equability or in non-equability of the essential agents, from the North German winter, except that their winters are milder and shorter. Compared with the South of England, they can scarcely be said to possess a warmer winter, but they have moreover a brighter sky. Their right to be called health-resorts, and to gather together a number of unoccupied sick persons, lies in a more healthful life and more plentiful use of fresh air.

Montreux.

Montreux, 1,186 feet above the sea, a collection of parishes of various names on the eastern shore of the Lake of Geneva. The most sheltered of these is the real *Montreux*, but it affords only scanty opportunity for promenades. There are constantly gloomy days in winter, especially in December and March. An unpleasantly low degree of temperature is not unusual. There are numerous cheap and well-arranged boarding-houses. Railway station. (Dr. Carrard.)

Bez, 1,259 feet high, in the valley of the Rhone, in a very sheltered situation, with beautiful promenades and reasonable prices; it possesses somewhat more agreeable conditions of weather than *Montreux*, especially in the spring. Railway station.

Gersau, 1,361 feet high, a steamboat-station on the Lake of Lucerne, is, it is true, on an average, somewhat cooler than the preceding places, but more equable in temperature. It has also greater moisture of atmosphere, and accordingly more bright days, than Montreux. The situation necessitates great stillness of atmosphere. The accommodation is still limited. Gersau.

Baden-Baden, 618 feet high, has a milder and more agreeable winter than most parts of Germany, and from its situation it also has a comparatively still atmosphere. Baden-Baden.

Wiesbaden has a similarly mild winter, especially in the quarter of the town where the warm springs appear. The town, which is well-drained, contains good hotels and dwelling-houses. Wiesbaden.

At the close of this chapter we shall give, as accurately as we can, from the abundant literature on the subject and the results of our own experience, a list of the most important health-resorts, arranged according to the intensity of the more important climatic influences. The last section gives the average differences of temperature; it is, however, unfortunately very limited. Among the deficiencies under which the observations with regard to climatic resorts suffer, and which may almost bring the critical investigator to despair, the nearly absolute lack of material for estimating the constancy or variability of a climate is certainly the saddest. Everything imaginable is observed, every item is noted down with scrupulous accuracy, in order afterwards to be able to announce that the health-resort X possesses half a degree higher average temperature in winter than the health-resort Y; but to investigate from what figures these averages are derived, occurs but to very few. Table of health-resorts.

BOOK V.

THE METHOD OF BALNEOTHERAPEUTIC CURES.—REGIMEN.—
DIET.—ARTIFICIAL MINERAL WATERS.

IF, as we pointed out in the prefatory remarks, and as we have shown throughout the whole course of the discipline laid down, Balneotherapy in itself is no scientific whole, but only a *résumé* of much scattered material belonging to general and special therapy and pharmacodynamics; if it has to do with various constitutions, diseases, remedies, and methods, we are the less justified in attempting to establish a system of dietetics adapted for medicinal waters, *i.e.* in forming one *résumé* out of another; *the remedy is the method*; the case itself gives rise to both remedy and method, and a general statement is not capable of satisfying those who, after having studied balneotherapy, yet require special instruction as regards the regimen to be pursued during courses of baths and waters. A few widely spread and popularly written so-called ‘Brunner’ dietetics by clever physicians of the earlier school have strengthened the public in certain prejudices which are opposed to the rational maxims of modern science (see p. 28 *et seq.*), and in the superstitious belief, especially, that the sick person, as well as the physician, as soon as a balneotherapeutic course of treatment is in question, quits the range of ordinary medicine, and enters a wholly new field of specific relations, the veil of which is only permitted to be raised by the initiated.

Impracticability of a system of dietetics for course of waters.

We shall here only add some remarks with regard to a few points relating to the method to be pursued, namely, with regard to the physician at the spa, with regard to the time and duration of the course generally, and with regard to the use of artificial mineral waters instead of natural ones.

1. THE PHYSICIAN AT THE SPA.

The spa-physician.

Care is taken at most spas that the treatment of serious cases is entrusted to a competent physician. This competence relates, however, only partially to his intimate acquaintance with the ordinary remedial resources of the place. In a greater and far more important degree it relates to his knowledge of the respective branch of nosology, to his practical skill generally, to his conscientiousness, and to those personal qualities by which he must gain, not only the confidence, but also the obedient acquiescence, of a sick man hitherto unknown to him. In many simple cases it is enough that the spa-physician should watch the course of the treatment, in order to obtain a basis for the estimation of its success or failure. In other cases greater demands are made upon him. 1. He has to gain an accurate perception of the case and the individuality of the sick person, and in a very short time to see through a condition which is the product of long disease unobserved by him, and frequently the result of a whole pathological life. Accurate information in this case is required on the part of the family physician, and also a certain special acquaintance with the class of similar conditions. 2. He has to decide the mode of treatment, according to the individuality of the case, to modify it in its course when requisite, and altogether to carry it out. 3. He has to observe and to treat incidental occurrences, the number and kind of which are incalculable. 4. He has to ascertain the limits to which the treatment may and can be carried. Lastly, 5. He has to make the most of the case for his own experience, and to render it advantageous also to the family practitioner, interchanging communications with him from his own special experience, and from his careful observation of the case, communications which enable the latter to estimate the effect of the remedies used, and of the method of using them.

If we add to the requisites just mentioned the necessity that the spa-physician, by his personal qualities, should be

imposing to the sick person, who has often become impatient from long illness and vain attempts at recovery, and has lost the habit of obeying the physician, and who is, moreover, readily inclined to yield to the seductions of society and to free himself from medical superintendence at the trivial insinuations of conceited habitual visitors of the spa; if we add to them, lastly, the knowledge of foreign languages, and even of foreign maxims of medical science, requisite for many spa-physicians, there results an amount of general and of professional knowledge, which places the position of spa-physicians far above the level of the ordinary majority, and which imposes on the medical public the necessity of becoming acquainted with these individuals, in order to enter into communication with them, and to agree with them, or to come to an understanding with them respecting the individual treatment of cases. Visits to spas, personal acquaintance with the physicians, and the knowledge of their methods in important cases, are therefore highly desirable.

2. THE PERIOD FOR COURSES OF BATHS AND WATERS.

Generally speaking, in accordance with the principles stated at page 43 *et seq.*, the *warm season of the year* is the period which affords all those common curative influences, the importance of which was shown in the First Book. Warmth of the air must be regarded as specially requisite. It is necessary, however, even as regards this point, that the decision should be guided only by the individual circumstances of the case, and by that of the spa in question. With respect to the latter, in the first place, a knowledge of the local climate is of great importance. While many places of less elevation above the level of the sea, either owing to their situation in narrow and deeply indented valleys, or from their southern or continental situation, suffer from continuous or variable high degrees of heat, there are others of equally low elevation which are exposed to more constant and cooling currents of air, and which, therefore, do not present those sudden changes of temperature which form the rule in low valleys.

Period for
baths.

Heat of
summer.

A salutary advance has in this respect been made in the opinion of physicians. Whilst, formerly, great importance was attached to extreme stillness of air and to extreme heat altogether, far more stress is now laid, and justly so, on a moderately warm and agitated air, especially from the experience gained in phthisical cases, which are with advantage allowed to breathe cooler and even cold air, presupposing that a protection is afforded against the influence of the cold on the skin by clothing and regimen. Certain periodical variations take place in habits and maxims of this kind, especially in Germany, according to the state of weather prevailing in a number of summers. In the wet and cold summers preceding the year 1868 cooler and more highly situated spas, and even sea-baths, produced some unsatisfactory results, whilst in the continuously hot summer of 1868 the agitated air of many places, and especially on the sea-shore, was welcome. A summer of this kind removes many prejudices, especially the belief that night-air is absolutely pernicious to persons sleeping. The author, during this summer, allowed almost all his patients to sleep with the window open, and thus protected them from being over-heated, which, in bath treatment especially, is no less to be avoided than taking cold. The condition of a sick person going through a course of baths during great continuous and even nocturnal heat rises quickly to feverish heat, with all the symptoms observed in fever, and urgently requires a periodical cooling of the heat of the blood; in the same way as we are now more generally opposed to the nursery belief, that children, with their great power of producing heat, should be wrapped up in thick coverings and prevented from lying uncovered. We may say that the hottest months are less adapted for courses of baths and waters than the milder months of the spring and late summer; and if, nevertheless, the former period presents the highest contingent for this treatment, this arises partly from old habit and partly from the number of cool summers which Central Europe, and Germany especially, has experienced during long periods, the last from 1859 to 1867.

The knowledge of the *climatic conditions* of a spa is in nowise sufficient to afford a guarantee, in the choice of period, that no hindrance will occur in this respect to the success of the treatment. The climate is only the general, and, as it were, theoretical framework, which is filled by the practical substance of the *weather*, and the weather is probably to be less estimated by the local climate of a place than by the general climate of the zone; and no error is more frequent than to imagine that a prevalence of good weather during the limited period of a summer-cure is a necessary result of the boasted climate of a place. Storms coming up from the west in May and June are able to produce from 4 to 6 weeks of continuously wet and cold weather in Central Europe; and this has been so constantly the case in the last ten years, that Dove, although with some exaggeration, asserted that most of the courses of bath-treatment had been in consequence frustrated. General climatic facts can therefore only afford very general chances for a course of treatment, and these based on but slight probability; and we only venture to mention the most general facts, in order to give an approximate standard for calculating the weather beforehand. These facts are as follows.

1. The slightest variations, daily and monthly, take place by the seaside.

2. The greatest liability to rain appears on the shores of the Mediterranean.

3. The minimum temperature of the day prevails a short period before sunrise; the maximum in spring and autumn, at two o'clock in the afternoon; in summer, from two to three o'clock; and in winter from twelve to one. In spring and autumn the temperature of the day rises for about 9 hours, namely, from five to two o'clock, and falls for 15 hours, namely, from two to five o'clock. In summer it rises for 12 hours, namely, from three to three o'clock, and falls for the same period. The variation during the day is slightest in the winter; it is highest in summer, and in spring and autumn it is at a medium amount.

4. All evaporation from the skin ceases in mist.

Climatic
conditions.

5. In Central Europe mild winters and cool summers are more frequent than the reverse; the vicinity of the North Sea warms the air, that of the Baltic cools it. September is the least variable month in Central Europe. Nature falls asleep peacefully in the autumn, and awakens stormily, with violent interruptions and outbursts, in the spring; May especially exhibits great variations during the day.

6. The variations during the day of the heat of the air, as to the course of their phases, correspond nearly with the variations of the heat of the body; and this is an important point as regards the method of treatment to be pursued, in so far as all courses of treatment which affect the natural heat are most suitably carried out at a time when both atmospheric and natural heat are in the ascendent phase.

7. The radiating heat of the sun acts most strongly at the time when the air is saturated with vapour: therefore, somewhat after noon and in mid-summer.

8. The *summer* is the best period for courses of baths and waters, not because a higher degree of atmospheric heat is requisite, but only because in the milder season of the year constant exposure to the unheated, unvitiated, open air is possible. We protect ourselves from the cold in winter by heated and closed rooms, and in summer we shield ourselves from the heat by cool and ventilated rooms and by forest-shade. This view shows the importance of the question of lodgings in all summer treatment, and every spa-physician sees yearly very many cases in which the treatment is frustrated by the narrowness of rooms.

Such and similar are the maxims which influence the success of a course of treatment as regards climate and weather.

High
situation.

As the temperature of a place is essentially modified by the *height of its situation*, this circumstance must be also taken into consideration with respect to the period of the treatment, in so far as by selecting a high mountain-spa the sick person can be kept from extreme degrees of heat even in the warmest months. With regard, however,

to the *sea-side*, it is well to consider in the choice whether the sick person can find shade, especially in his daily walks on the sea-shore, or whether, as is unfortunately the case in many places, he is exposed to the burning, heating, and relaxing rays of the sun; and this precaution must also be observed in all the elevated, and especially the very elevated health-resorts, because, as Tyndall and others have remarked, it is especially in rarefied air that the radiating heat of the sun produces a powerful effect on the human organism, and that even in a temperature which does not allow the snow to melt in the sunshine.

Radiating
heat in
rarefied
air.

If the urgency of the case require a course of baths in the cold season of the year, which in the northern parts of the temperate zone is characterised by violent and cold currents of air, then, in order to protect the sick person from taking cold, and to facilitate the reaction and resistance of the body as far as possible, a treatment is requisite which can rarely be carried out at a spa, and for the most part can only be observed at home; in this case, a large and heated apartment is especially requisite, in which the sick person can take exercise, and which ought to be immediately connected with the bath-room. There are several spas in South Germany, in the Pyrenees and in Switzerland, adapted for the early spring and late autumn months, where generally a milder temperature can be reckoned upon, and in this respect we can specially recommend Bex, in Switzerland; Bex, even in February and March, has a climate similar to the German May, and the autumn there is warm, even to the months of October and November.

Courses of
baths in
the cool
season of
the year.

[It is very desirable that it should be more generally borne in mind that September and the first weeks of October offer still satisfactory conditions at several spas which are crowded in July and August, and become completely deserted after the first week in September; while for constitutions requiring a cooler air the whole of September and the beginning of October are preferable to the great heat of July and of the beginning of August. Such is the case, for instance, with Ragatz, with Bormio, and as regards September at all events, with Ems, Neuen-

ahr, Soden, Wiesbaden, Aix-la-Chapelle, Kissingen, and Homburg. Visitors have in September the additional advantage of greater choice of good rooms and better attendance.]

Period for
courses of
waters.

The period for courses of waters is far less limited than that for baths, presupposing that the two systems are not combined. There is no spring which cannot be borne in cool air and in severe winter cold. It is true those important influences which the summer affords are then lacking; but the peculiar and direct effect of the component parts, of the common salt, the sulphur, the Glauber's salt, the soda, the carbonic acid, and the iron, are not affected by the coldness of the season; and carbonic acid is even better borne in cool weather than under the influence of greater heat.

Time for
drinking
waters.

The time for drinking waters is predominantly the early hours of the day, because the empty stomach and the vessels of the stomach which have been left unsupplied for many hours are better inclined to absorb the water. When, however, the daily dose prescribed is greater than can be taken at once in the individual condition of the sick person, in addition to the morning dose, smaller quantities may be taken an hour before the early dinner, and even before supper. Too great stress has frequently been laid on the necessity of fasting, and a quantity of warm or cold water has been forced upon many a tortured sick person in the early morning, when his stomach has not been able to bear it; less objection is at the same time usually raised against the often nauseous addition of whey and milk, than against the wholesome enjoyment of a cup of warm tea or coffee previously to the waters; this is interdicted as a pernicious experiment, although the milk and whey added to the waters also require to be digested by the stomach. Many sick persons require stimulants of this kind, and cannot digest the waters, especially when taken cold, unless preceded by a cup of coffee or tea, which is quickly absorbed. Simple and alkaline acidulated waters are frequently not impeded in their absorption and effect by the simultaneous digestive process of the stomach, and by their coming into contact with food and chyme, and

some of them may even be taken with great advantage at meal-times ; for instance, those of Vichy, Fachingen, Ems, and Wildungen [and still more those of Apollinaris, Selters, Roisdorf, Geilnau, Schwalheim, Giesshübel, and St. Galmier.] The advantage of this is, that very large quantities of mineral water can be taken during the day without supplying the blood with more than a bearable quantity of fluid. This dietetic drinking of waters during the day and at meal-times is especially to be taken into consideration in cases of gout, gravel, catarrh of the bladder, and diabetes, where great quantities of water are necessary ; only an immoderate amount of carbonic acid has to be avoided, and this can be done by shaking the waters or allowing them to stand for some time before drinking.

The temperature of the waters is regulated partly according to their amount of salt, and partly according to the individual condition of the stomach. Generally speaking, the sulphates are less required to be absorbed at the stomach, but are intended to act rather as stimulants to the intestinal mucous membrane ; hence they are taken either cold or cool, because they are less easily absorbed at a lower temperature, and they better stimulate the stomach to peristaltic action, and consequently to its propulsion of them into the bowels. The more, however, rapid and complete absorption is desired, the more are warmer waters indicated ; and this is the case especially as regards carbonate of soda, and frequently also common salt, when the effect of this on the blood is predominantly intended. Nevertheless, this is only a general rule, admitting many individual exceptions ; and the absorption of cold waters may also be facilitated by distribution into several smaller doses. It is generally very soon found by the condition of the stomach, and especially of the bowels, whether the direct effect of the mineral water and its absorption have to be assisted by dividing the doses or by heating the waters ; steel springs and alkaline waters, the latter even when they contain moderate quantities of sulphates, have, as a rule, a somewhat constipating effect ; they are for the most part absorbed, and the same may be said frequently even of weaker common-salt-waters. On the other hand, if, as is

Tempera-
ture of the
waters.

often observed, these waters produce serous or even catarrhal diarrhoea, this is a sign that they are not sufficiently absorbed, that they act as a stimulant on the intestinal membrane, and therefore that their absorption must be promoted either by dividing the doses or by heating them. The same may be said of the stronger Glauber's salt, Epsom salt, and common salt waters, when they act as a stronger aperient than usual, or than the individual requires. The heating itself, when it is artificially produced, is either done by the addition of small quantities of very hot water, or by placing the water in a vessel filled with hot water. The first method is to be preferred when it is desired to retain the carbonic acid as far as possible, and the second when this consideration is less prominent; yet we may once again mention that the greater number of mineral waters contain far more carbonic acid than is required for their effect, and that a spring which does not undergo the process of boiling contains for a long time a considerable quantity of free gas. The custom still prevailing in many places, of heating the transmitted natural or the artificial mineral waters exactly to the same degree of temperature possessed by the original on the spot, is without foundation. The temperature must be regulated according to the nature of the case.

Time for
the bath.

The time for the bath has, generally speaking, been justly fixed by the empiricism of a hundred years on the principle that those phases of the day which are characterised by greater demands on the part of the organism should not precede the bath, but should follow it; namely, the work of digestion, greater bodily exercise, greater mental excitement, and the irritation of the entire organism by the events of the day. A course of evening baths is, therefore, rarely, and only exceptionally, prescribed; they are of use only, especially lukewarm ones, in occasionally palliating and calming the excitement resulting from the day, and in producing sleep. In real courses of bathing the baths are taken in the morning, either very early before breakfast, or some hours after the latter and before the early dinner. The choice between these two periods is not regulated, unfortunately, in all

places by the requirements of the case, but very often, in much-frequented places, by local arrangements. In Tep-litz, for instance, we find sick persons of a kind requiring indulgence obliged to interrupt their rest at four o'clock in the morning, in order to take a bath; and at Aix les Bains and Barèges, for the same reason, baths are taken at two o'clock in the morning. It is a matter of course that, if the cases be at all serious, any successful result is paralysed by such a course of treatment, and that a method of the kind can only be designated as erroneous. A spa-physician allowing such an erroneous method acts contrary to duty.

In general, the time of the bath is regulated by the reaction expected from the sick person. The more vigorous he is, the more can he compensate for a certain loss of warmth on leaving the warmth of bed; and therefore cooler and cold forms of baths requiring a considerable reaction are used early in the morning, and in a fasting condition. The same time is also recommended for those cases in which the cold or warm form of bath is to be succeeded by wrapping up or by perspiration in bed, because the work of digestion after breakfast may be disturbed by the heat of the body in bed, and this heat itself may rise to a pernicious extent. Frequently, however, the later hours of the forenoon are suitably chosen, and this for various reasons; for instance, on account of the weather, so that the sick person may take exercise in warm air after the bath; or on account of the individual condition of the patient, who may require the stimulant of breakfast in order to be able to bear the bath, and to be capable of the required reaction; or on account of the special properties of the bath itself, which require the condition of the patient after breakfast in order to facilitate its good effect. This is the case, for instance, with the thermal sool-baths of Rehme, the whole effect of which, owing to the stimulus of the carbonic acid, and the cooler bath temperature, requires, for the most part, after the bath a walk in moderately warm air; whilst many of the sick persons treated there are cases so needing indulgence, that they are gladly allowed the refreshing sti-

modus of breakfast and the enjoyment of the early morning. When, however, as in the year 1868, great and lasting summer heat prevails, baths are avoided, even by very delicate patients, in the hot noontide hours, and they are allowed to bathe early and fasting. This fasting condition, however, does not forbid in some cases a cup of coffee or tea, as this is rapidly absorbed without disturbing the effect of the bath. Rational physicians, therefore, often permit a division of the breakfast, by allowing before the bath a cup of warm drink, while the satisfying breakfast is taken afterwards. As we have above remarked, the forenoon hours are to be recommended for all forms of bath that withdraw heat, because this period coincides with the increase of natural heat.

Rest in
bed after
the bath.

The maxim that *the warmth of bed* should be indulged in for one or more hours *directly after the bath*, is justified by experience for many cases, but by no means for all. We must confess that still, at some very famous places—as, for instance, at Tepłitz—the erroneous system prevails of allowing rest in bed in most cases to follow the bath, without regard to the case, only because it has been customary since those dark ages when other magic influences than those of warm water were presupposed to exist in the Tepłitz springs. Rest in bed after the bath ought in nowise to be a matter of local habit and fashion; it is rather a maxim connected with very definite and decided indications. It is prescribed in general for two different purposes, either in the case of individuals requiring indulgence, who cannot duly compensate by open air and bodily exercise for the heat lost in a bath tempered below blood-heat, or in cases in which considerable perspiration is necessary for the lixiviation of the blood and the softening of the skin (in certain cases of exanthemata). In the first case, the wrapping up must be moderate; in the second it must be plentiful and air-proof, and in this case, generally, plenty of drink is taken, in order to promote the perspiration by supplies of water and to compensate for the loss of water in the blood. Both cases, however, form but the minority; wherever, on the other hand, the quieting and strengthening of the nervous

system, or gentle stimulation of the change of substance, is required, or where cases of neurosis, paralysis, tabes, anæmia, scrofula, and others are in question, it is an essential part of the thermal or the cold water system that an amount of bodily exercise in the open air, to be regulated individually, should follow the bath; and these cases form, indeed, the preponderating majority. Ignorant therefore, unpractical, and injudicious is a method which compels all or most sick persons to perspire in bed after the bath, for the sole reason that the old custom of the place, a custom belonging to an irrational age, has so established it.

The duration of each separate bath cannot be precisely determined beforehand in any case, but only with some probability. It results far rather experimentally from careful observation of the course and the immediate effect of the first baths. As the indication and selection of different baths, and the decision as to their form and temperature, mainly rest on the estimation of the individuality of the sick person, the duration of the bath does so all the more. The result of the single bath, and the effect upon the organism during and after the bath, require in many sick persons a very different duration of time, and none but very general rules can be drawn from the manifold experience on the subject.

Duration
of the
bath.

That cold forms of baths are in general of shorter duration than warm ones needs scarcely be mentioned, nor that very warm baths cannot be borne without injury so long as those of more moderate temperature. Cold baths last for seconds and minutes; all the shorter, the colder and more extensive they are, and all the longer, the less cold or the more local they are; for instance, cold hip-baths are borne from 15 to 20 minutes and still longer, and frequently require such a length of time, in order to produce an effect. Very warm baths, however, heat and excite the sick person, producing subsequent stupefaction and relaxation, and this all the more the higher their temperature. Both extremes require, as a rule, only a short period in order to obtain their direct effect—the cold as exciting reaction, and the very warm

mulus of breakfast and the enjoyment of the early morning. When, however, as in the year 1868, great and lasting summer heat prevails, baths are avoided, even by very delicate patients, in the hot noontide hours, and they are allowed to bathe early and fasting. This fasting condition, however, does not forbid in some cases a cup of coffee or tea, as this is rapidly absorbed without disturbing the effect of the bath. Rational physicians, therefore, often permit a division of the breakfast, by allowing before the bath a cup of warm drink, while the satisfying breakfast is taken afterwards. As we have above remarked, the forenoon hours are to be recommended for all forms of bath that withdraw heat, because this period coincides with the increase of natural heat.

Rest in
bed after
the bath.

The maxim that *the warmth of bed* should be indulged in for one or more hours *directly after the bath*, is justified by experience for many cases, but by no means for all. We must confess that still, at some very famous places—as, for instance, at Teplitz—the erroneous system prevails of allowing rest in bed in most cases to follow the bath, without regard to the case, only because it has been customary since those dark ages when other magic influences than those of warm water were presupposed to exist in the Teplitz springs. Rest in bed after the bath ought in nowise to be a matter of local habit and fashion; it is rather a maxim connected with very definite and decided indications. It is prescribed in general for two different purposes, either in the case of individuals requiring indulgence, who cannot duly compensate by open air and bodily exercise for the heat lost in a bath tempered below blood-heat, or in cases in which considerable perspiration is necessary for the lixiviation of the blood and the softening of the skin (in certain cases of exanthemata). In the first case, the wrapping up must be moderate; in the second it must be plentiful and air-proof, and in this case, generally, plenty of drink is taken, in order to promote the perspiration by supplies of water and to compensate for the loss of water in the blood. Both cases, however, form but the minority; wherever, on the other hand, the quieting and strengthening of the nervous

system, or gentle stimulation of the change of substance, is required, or where cases of neurosis, paralysis, tabes, anæmia, scrofula, and others are in question, it is an essential part of the thermal or the cold water system that an amount of bodily exercise in the open air, to be regulated individually, should follow the bath; and these cases form, indeed, the preponderating majority. Ignorant therefore, unpractical, and injudicious is a method which compels all or most sick persons to perspire in bed after the bath, for the sole reason that the old custom of the place, a custom belonging to an irrational age, has so established it.

The duration of each separate bath cannot be precisely determined beforehand in any case, but only with some probability. It results far rather experimentally from careful observation of the course and the immediate effect of the first baths. As the indication and selection of different baths, and the decision as to their form and temperature, mainly rest on the estimation of the individuality of the sick person, the duration of the bath does so all the more. The result of the single bath, and the effect upon the organism during and after the bath, require in many sick persons a very different duration of time, and none but very general rules can be drawn from the manifold experience on the subject.

Duration
of the
bath.

That cold forms of baths are in general of shorter duration than warm ones needs scarcely be mentioned, nor that very warm baths cannot be borne without injury so long as those of more moderate temperature. Cold baths last for seconds and minutes; all the shorter, the colder and more extensive they are, and all the longer, the less cold or the more local they are; for instance, cold hip-baths are borne from 15 to 20 minutes and still longer, and frequently require such a length of time, in order to produce an effect. Very warm baths, however, heat and excite the sick person, producing subsequent stupefaction and relaxation, and this all the more the higher their temperature. Both extremes require, as a rule, only a short period in order to obtain their direct effect—the cold as exciting reaction, and the very warm

as producing perspiration. From what has been said in the First Book with regard to the dynamic character of the two opposite effects of cold baths, it is evident that their depressing or exciting effect is far more dependent on their difference of *form* than on their duration; and only when much prolonged can exciting forms of baths, in consequence of the great loss of heat, be rendered depressing ones. In the average forms and bath temperatures of the thermal system, a great scope is given as regards the duration of the bath. It is prolonged from 5 to 60 and more minutes; and only when there is a great amount of carbonic acid the limit of half-an-hour ought not to be transgressed, and this is often already too much.¹

Very long
baths.

As there are still a few thermal bathing-resorts where all the sick are subjected to the method of three to eight hours' Piscine baths—for instance, Leuk—it is both scientifically and practically interesting to observe the direct and the final effect of these protracted baths and modes of bath-treatment. Nevertheless, establishments of the kind cannot be regarded as sound and reliable curative resorts, the effect of which can be calculated upon, because they apply a set form—and one, indeed, that is purely empirical—to the most different diseases in different constitutions. It is true there is no lack of favourable results, especially in skin-diseases, but the character of adventure always clings to these cures, and the author can state from experience that cases of diseases of the nervous system, and especially of tabes, in which judicious physicians endeavour carefully to adopt the method to each individual, have ended fatally at Leuk, because the patients have been allowed to bathe for many hours in succession, like persons suffering from eczema; whilst at Rehme, Gastein, and Wildbad the baths are often reckoned by minutes. The feeling of the patient is the principal means for deciding in individual cases the duration of the thermal treatment at the average temperature. The feeling of warmth which follows the first slight sense of chill lasts only for a certain time, and after its termination it gives place to a new and

¹ See the chapter on Thermal Sool-baths.

increased feeling of cold, which ought to determine the limit of the bath.

The combination of a course of baths with a course of mineral waters is in nowise an indifferent matter, and frequently demands mature consideration, and careful arrangement and distribution of the different influences of the treatment. Generally speaking, it would be desirable in many cases if the two courses of treatment were undertaken separately at different times; nevertheless, with most sick persons the economical disposal of time is a consideration, and comparatively few have time and opportunity to go through the two courses separately. It is, therefore, necessary to take care, both as regards method and regimen, that the powers of the sick person be not tried beyond a certain measure by the double treatment, and that the effect of the one remedy do not either paralyse that of the other or increase it to a pernicious extent. To give rules on this matter is quite impossible; at the most, we can only indicate a few chance examples for the thousand possibilities which may be presented by individual cases. Thus, very vigorous individuals, owing to strong stimulation of the change of substance, can without injury begin with the bath in a fasting condition and then drink the waters, taking active bodily exercise; while others begin with the waters, taking the bath some hours after breakfast, and after recovering from the promenade at the spring; those persons, however, requiring very indulgent treatment cannot often bear this method, and are obliged to alternate the waters and the bath, a very salutary plan, which is unfortunately only little practised, because a sick person has rarely the time and patience necessary. Further, it is in many cases not a matter of indifference whether and to what extent the weakening or the existing effect of the one influence increases the similar result of the other in an unsuitable or insufferable degree; a very warm or a very cold bath in combination with a strongly lixiviating spring, or a bath rich in carbonic acid, combined with a spring equally rich in carbonic acid or with a steel-spring, are often hazardous combinations, the

Combina-
tion of
baths and
waters.

possible graduation of which ought to be carefully measured in the individual case. Very frequently the spa-physician is obliged to choose between the two remedies, and in that case the decision rests on the question as to which of them corresponds, either generally or for the time being, with the more important indications.

Promenade at the springs.

The promenade at the springs is also among the maxims which often sink into old prejudices and abuses : to drink a glass every quarter of an hour, to walk between, and after the last glass to walk from three-quarters of an hour to an hour—this is the general rule. It is certain that to very many spa-patients a morning walk is salutary, and all the more so, the more it is combined with a moderate amount of social enjoyment and with agreeable music ; moreover, especially when large doses are taken daily, physical exercise is conducive to the more rapid absorption of the waters. But this is not always the case ; to many invalids the morning walk is a fatigue which exhausts them for the whole day ; many mineral waters, especially acidulated waters, sulphur-waters, soda-waters, and even the weaker common-salt-waters, and especially warm springs, are, when taken in moderate quantities, as easily and often more easily absorbed during physical repose, and even in the warmth of bed, than during exercise ; indeed, with some waters, and with many persons, absorption is even impeded by exercise, and this is often especially the case with stronger common-salt-waters, and with springs containing sulphates, which frequently with the slightest exercise stimulate the stomach violently to contract and rapidly to push on its contents into the bowels, the mucous membrane of which is thus often sooner and more strongly acted upon than is desirable. The individual case can alone dictate the method, and frequently this must be modified even during the course of the treatment.

Diet.

With regard to diet, and the impossibility of giving general precepts, see p. 26 *et seq.*, especially with regard to the unfounded general prohibition of wine and vegetable acids during the use of alkaline waters, and of butter, in most courses of medicinal springs. While such old-estab-

lished prejudices are attended to, the judicious arrangement of the breakfast is often neglected: at many spas, the sick person, after having taken great quantities of the waters, is allowed to satisfy the hunger caused by his morning walk with a large amount of indigestible amylacea, instead of being supplied with a less voluminous, easily digestible, and far more advantageous meat-breakfast, which, moreover, for many nervous invalids forms the most salutary reform in their mode of life, especially in very obstinate cases of chlorotic dyspepsia, with the emaciation that accompanies it. There is, moreover, often a neglect in regulating the nature of the mid-day meal, the choice of which, both in a qualitative and quantitative point of view, is at many spas left to the host and to the fancy of the sick person, and it is therefore very often a luxurious feast. It is incredible how many courses of baths and waters prove unsuccessful only because the sick persons do not have daily a simple mid-day meal, but partake of an hotel dinner; or, in other cases, because they are compelled to drink quantities of cold mineral waters in a morning fasting, without having quieted their nerves by the innocent enjoyment of a cup of warm tea or coffee. The usual number of three meals does not suit all persons, but must often be exceeded.

The duration of a course of baths or waters cannot Duration
of the
course,
at all be decided generally, and can only be approximately fixed for special cases. It is regulated by the very different individual conditions, by incalculable events in the course of the treatment, by the weather, and, in short, by circumstances the appreciation of which is the main task and skill of the physician. It is true, in course of time, certain average limits have resulted as regards different remedies and methods, and different conditions of illness; but these can only afford a probable calculation as regards individual cases. Above all, it is necessary to form a tolerably correct prognosis of the case, to distinguish the attainable from the unattainable, to reserve all that is impossible at present for subsequent treatment, to estimate the capability of the diseased organism, and, moreover, from the first to make it plain to the invalid

person himself how much is to be achieved within a certain time, and what is to be left for a repetition of the treatment, or for the future generally. It is true, in most cases the wish forces itself also on the physician to make the most of a remedy, the use of which has imposed on the sick person such great and expensive arrangements, and therefore in general the principle must prevail of pursuing the treatment as far as possible; but this 'possible' limit must be determined with care, and in this lies the great value of the judgment of the spa-physician.

Frequently the duration of a course depends on the remedy that characterises it, as, for example, in very energetic cold water and thermal cures, which can be borne only for a short time by most sick persons, and which, moreover, manifest their effect all the more rapidly the greater the energy with which they are carried out; and, therefore, as we have already elsewhere remarked, the principle of many cold water establishments is to blame for protracting the course too long, in the often vainly cherished wish of obtaining the desired result in one year or in one course of treatment. Frequently, also, the duration and degree of a course of treatment depends on the general prognosis of the disease; for instance, in gouty exudations, in which we have frequently to be satisfied with a moderate improvement of the general health, and with a slight diminution of the exudations, or with a check given to them. Frequently, also, it depends on the individuality of the sick person and the individual result of the course itself, by means of which alone the capability of the sick person himself is ascertained. Lastly, various accompanying circumstances have to be taken into consideration, and these not unfrequently add their weight with some decision; for instance, the course prescribed for a sick person suffering from rheumatic exudations is only four weeks in duration, and these four weeks are an invaluable period to him, and must be made use of for his recovery. If double the time were prescribed, the course of treatment would be pursued moderately or slowly, while now it is necessary to choose the course to be adopted according to the prevailing symptoms of the case.

Either the greatest importance is to be attached to the exudations, and in this case a very energetic method for promoting absorption within the given time must be adopted; or weakness of skin is the predominant symptom, and this causal indication has to be met by a moderate and cool method, and the sick person has to be consoled with the promise of the diminution of the exudations at a later period, and by means of energetic thermal treatment. Such instances show that it is unadvisable to lay down general rules for the duration and degree of the course of treatment, and that such dogmatic regulations as are now and then given by more or less known physicians, like accurately dosed recipes, belong to a very doubtful system of perfection. It is true some specially famous spas, which are frequented by a great number of similar cases of illness, similar at any rate in kind, owe their reputation in great measure to the methods which their physicians have ascertained and brought to perfection; but these methods have only a general importance, and they require to be modified individually, according to the individual case. With regard to the treatment before and after the course, see p. 45.

3. ARTIFICIAL MINERAL WATERS.

The appreciation of artificial mineral waters as pharmaceutical remedies was at first obscured by the confusion of contending parties, and even at the present day it is met by a difficulty, though of a purely technical character.

After *Berzelius'* works had opened the way for an actual analysis of mineral springs, and a few imperfect attempts had been made to imitate them, Struve produced his comprehensive analytical works, and an artificial construction of the waters most in use in accordance with their complete analysis. His first work, 'On the Imitation of Natural Curative Springs,' appeared in 1824.

The deficient means of communication at that time, which rendered the transport of mineral waters both difficult and expensive, and the oft-made experience that by

filling and transmission they lost a great part of their carbonic acid and iron, induced many physicians to welcome gladly the new invention. Nevertheless, it met with but a tardy and imperfect reception, even in Germany, where numerous branch manufactories had been established. The reasons for this were various. Above all, an impediment existed in the mystery which Struve's manufactory for a long time preserved, and in the well-founded aversion of physicians to accept pharmaceutical preparations on trust, the manufacture of which formed a large and lucrative business to their makers. Moreover, at that time there was still a tendency to believe in the wonder-working effects of natural bodies, the conditions of which it was not possible for art to imitate, and in a mysterious relation existing between those inorganic combinations and organic juices and so-called vital force. The objections raised against Struve's manufactures only related, it is true, to theoretic possibilities; but they were effectual, for the very reason that these hypotheses were in harmony with the general opinions of the time. It was asserted, for instance, that the artificial waters lacked the inimitable properties of natural ones, such as free electricity, natural heat (which was regarded as quite different from artificial heat in its effects), affinity with organic bodies, and the peculiar life of the springs and their direct animating power.

Under such circumstances the dispute was necessarily carried on upon fruitless theoretic grounds, and this all the more, as the practical standard of success and failure never stood out clearly and distinctly from this theoretic obscurity. At a time, for instance, when no high importance had as yet been attached to the general influences of a course of waters, of travel, of mountain-air and the like, there were no decisive grounds for explaining the success and failure of the use of artificial waters.

With the more rational tendency of medical science, artificial mineral waters have now, it is true, like the natural, obtained an appreciation as pharmaceutical remedies according to their component parts; but the mistrust has not wholly vanished, because the mystery of their

manufacture in great measure still exists. Any control over it is impossible, and the recent advances made in analysis have far outstripped the old Struve standpoint. The belief also in the perfectly faithful imitation of nature is opposed by the fact, that many component parts of the springs are found only in their fundamental elements, though they are *calculated* in their combinations, and that often more than *one* calculation is possible. The important objection as to the deposit of iron is shared, however, both by the artificial and by the natural waters; the difficulty in filling the bottles, of preventing the admission of oxygen, and thus of hindering the precipitation of the iron, is equally great in both. This difficulty has recently been in a great measure removed by Fresenius' treatment of the natural springs; whether this can also affect the artificial waters is a matter not yet ascertained, as we do not know the management of Struve's manufactory, and an analysis of water is too great a task for many chemists to undertake, in order to test the Struve imitations. In general, however, the nature of the better artificial productions shows that they are carefully and successfully manufactured.

As regards more simple waters, those especially which are supposed to produce an effect owing to the presence of one or more salts—of common salt, of Epsom and Glauber's salts, and of carbonate of soda—it may be indifferent whether they are used in an artificial or in a natural form. The artificial waters are over-impregnated with carbonic acid, and this element is in nowise lacking in the natural, thanks to the new method; but supposing that the artificial waters contained a few grains more or less of the effective salt, this is proved in the observation of their effect; and, moreover, the dose of the natural spring is fixed and modified empirically and individually. It is well known that many of the more complicated natural waters are turbid in their transmitted condition. This has been the case especially during the last few years with the Kissingen and Marienbad waters.

The case is different with the steel-springs, the natural form of which, since the introduction of Fresenius' method

of filling the bottles, is to be preferred, or, at least, is no longer regarded as inferior to the artificial. In the old method the transmitted iron waters lost all the iron, which was deposited as ochre, although the escape of the carbonic acid, which was considered as the cause of this deposit, was to a great degree avoided. Fresenius proved that the surplus carbonic acid can only tend to obviate this evil by preventing the admission of air, and that, therefore, far more depends on keeping off all oxygen; his method consists in filling the empty bottle first with carbonic acid gas, and then allowing the water to enter, which water does not, therefore, come into contact with atmospheric air, and has no opportunity of absorbing oxygen; as, however, two-thirds of a cubic inch of atmospheric air are sufficient to change into an oxide, and to precipitate as such, all the oxide of iron in a bottle of strong steel-water, immediately after the bottle is filled, a current of carbonic acid is directed into it, in order to remove any air that may have been absorbed. The proceeding is simple, it is true, but it requires an accurate apparatus and great care, and is just as indispensable for artificial waters as for natural. So long, therefore, as no control over their manufacture is open to the public, we shall rightly prefer the natural steel-waters, filled in the new method, especially those of Schwalbach, to the artificially prepared waters; and we shall give preference also to those natural compound waters in which an effect of iron is combined with that of other component parts, as, for example, Marienbad, Franzensbad, and Elster, above their manufactured imitations. It is of course necessary for this that sufficient and reliable proof should be afforded as to the correct filling of the natural waters in question.

Recently a few not imitated but arbitrarily composed artificial waters have appeared, such as Struve's pyrophosphate of iron water, and his acidulated bitter water, and artificial seltzer and soda waters; the former two adapted for regular courses of treatment, and the latter for dietetic use, and very variably prepared. The artificial seltzer and soda waters are essentially acidulated waters, containing a slight amount of soda; the standard of their

goodness and purity is the taste of muriatic or tartaric acid, which may adhere to them if carelessly manufactured. Struve's acidulated bitter water is said to contain 3 drachms of sulphate of magnesia, and $\frac{1}{2}$ drachm of bicarbonate of soda to 18 ounces; or 160 grains and 27 grains to 16 ounces. The carbonate-of-magnesia-water contains 112 grains of carbonate of magnesia to 16 ounces; and the carbonate-of-lithia-water, from 2 to 5 grains in a bottle.

[A disadvantage of artificial mineral waters containing carbonic acid consists in the fact that this gas escapes far more rapidly when the bottle is opened than it does with natural waters, and that the water thus speedily becomes insipid; a still greater disadvantage, however, lies in the possibility that the water used for the preparation of artificial mineral waters may not be free from impurities, especially of an organic nature. A physician, further, has recently drawn attention to the fact that the artificial potash, soda, and seltzer waters, contained in ordinary syphon-bottles, are often tainted with lead.¹]

¹ See *Brit. Med. Journal*, Feb. 14, 1874.

I

I

INDEX.

ABA

- ABANO**, sulphur-baths at, 292
 Abdomen, plethora of, its treatment by thermal sool-baths, 242; by soda-waters, 341, 344, 352; by common salt-waters, 396; by Carlsbad waters, 374; summary of treatment of, 489. *See* Bowels.
Aber, Abergyle, Aberystwith, sea-bathing places, 263
 Abortion, habitual, thermal sool-baths in, 242
 Absorption of water by the stomach and its veins, 67; through the skin, 78; of gases, 78; of salts, 79; promoted by warm bath, 127
 Acids, vegetable, prohibition of, 29; formic and other volatile in moor-baths, 298
 Acidulated springs, 315
 Acne, not cured by sool-baths, 198; action of sulphur on, 274
Acqui, warm baths of, 170, 181
Adelheid spring, common salt-waters of, 204, 407; iodine compounds in, 205; chlorides in, 206, 209, 402; sool-baths, 215; carbonic acid in, 316, 402; iron in, 464
Aibling, sool-baths at, 225
 Air, country, as a remedy, 31; purity of, 32; ozone in, 32; organic dust in, 33; products of decomposition in, 34; carbonic acid in, 35; influence of vegetation of, 37; moisture of, 37; different density of, 47; temperature of, in relation to blood, 87; medium temperature of, 92; in relation to phthisis, 531, *et seq.*; pure, necessity of, 531; temperature of, 533; moisture of, 534; pressure of, 536, 563; diminished oxygen in, 573; dryness of, 574
 Air, condensed, theories of effect of, 48; respiration in, 51; use of, 49, 563; summary of effects of, 53

ALE

- Air, mountain, Schlagintweit's observations on, 54; effects of, compared with sea air, 55; characteristic effects of, 58; Tyndall and Frankland's experiments on combustion in, 59; Beneke's and Frankland's observations, 61; in hysteria, 111; effect of in phthisis, 571
 Air, rarefied, theories of effect of, 48; respiration in, 51
 Air, sea, compared with mountain-air, 55, 63; effects of, 252; temperature of, 253; density of, 254; purity of, 254; general indications for, 255
 Air-pump, condition of animals under, 51
Aix-la-Chapelle, waters of, used in gout and rheumatism, 138, 275; sulphuretted hydrogen and chlorides in, 268; mixed treatment at, 271; sulphur-baths, 285; compared with Mehadia baths, 293; analysis of, 420; carbonate of lime in water, 428
Aix-les-Bains, waters of, used in gout, 138; sulphur-baths, 284; analysis of waters, 420
Ajaccio, a health-resort, 595; winter temperature of, 612
Albisbrunn, cold-water establishment, 121
 Albumen, how dissolved in blood, 322, 385
 Albumen-dyscrasia of scrofula, remedies for, 324
 Alcohol, use of, in phthisis, 545
Aidborough, a sea-bathing place, 262
Alexandersbad, a cold-water establishment, 120, 579; pine-wood baths at, 306; a health-resort, 579
Alexisbad, effects of baths of, 304; carbonic acid in waters of, 316; whey establishment at, 439; iron-springs of, 465, 466; elevation of, 466

ALG

Algerian thermal-baths, 183, 294
Algiers, as a health-resort in phthisis, 596; winter temperature and rain in, 612
 Alkalence of blood maintained by soda, 321
 Alkaline springs, use of, for baths, 301; acidulated springs, carbonic acid in, 315; muriatic, saline, and chalybeate acidulated, carbonic acid in, 316; carbonate of soda in, 320
 Alkaline or soda waters, enumeration of, 342. *See* Soda-waters
 Alpine air. *See* Air, mountain
Allwässer, cold spring at, 303; carbonic acid in, 316; iron-springs of, 465, 467; elevation of, 466
Amélie-les-Bains, sulphur-baths of, 284; analysis of waters, 420
 American elevated spas, 587
 Amylaceous food, effect of chloride of sodium on digestion of, 388
 Anæmia, effect of sea-air and mountain-air on, 56; cold not well borne in, 103; in difficult convalescence, 132; paralytic weakness from, 150; treatment of, by sool-baths, 206, 242; by sea-baths, 259; cases which do not bear iron, 380; treatment by iron, 451, 455; summary of treatment of, 484
 Andes, results of observations on, 55; Peruvian, a health-resort on, 587
Andreasberg, pine-wood-baths at, 306; a health-resort, 579
 Animal heat. *See* Heat, Animal.
Antogast, cold alkaline spring at, 303; iron spring at, 465, 467; elevation of, 466
 Apex-catarrh, phthisical, 519
Apollinaris water, carbonic acid in, 315; chloride of sodium in, 329; description of, 347; use in catarrh of stomach, 394; iron in, 464
 Apoplexy of brain, a rare effect of cold bath, 97; treatment of, 155; of spinal cord, treatment of, 156, 496
Appenzell, whey establishment at, 440
Arapatak, iron-springs at, 465, 466
Arcachon, a health-resort in phthisis, 600
Arco, a health-resort in phthisis, 608; minimum temperature of, 612
Ardrossan, a sea-bathing place, 263
Arnstadt, common salt in waters of, 204; sool-springs and mother-lye, 209; sool-baths, 227; pine-wood and other baths, 306
 Arsenic, in mineral waters, 478
 Arthritis deformans, hydrotherapy not to be used in, 117; of spine, 163

BAS

Articular rheumatism. *See* Rheumatism
 Asthma, palliation of by pneumatic apparatus, 49
 Atlantic Ocean, chlorides in, 257; watering places on coast of, 265
 Atmosphere. *See* Air
 Atony of skin, *see* Skin; of stomach, *see* Stomach
Aussee, sool-baths at, 224; a health-resort in phthisis, 580
Ax, sulphur-baths at, 284
Azores, as a health-resort, 594

BADEN-BADEN, weak sool-baths at, 211; use of waters in catarrh of stomach, 334; temperature of waters, 335; use of waters in abdominal congestion, 397; carbonic acid and chlorides in waters of, 204, 334, 402; iron in, 404; common-salt-waters of, 408; lithia in water, 479; arsenic in, 480; a health-resort, 611
Baden (in Switzerland), sulphuretted hydrogen and chlorides in waters, 268; sulphur-baths at, 287; analysis of waters, 420; sulphate of lime in water, 427; carbonate of lime in, 428
Bad-n (near Vienna), sulphuretted hydrogen and salts in waters, 268; sulphur-baths at, 286; analysis of waters, 420; sulphate of lime in waters, 426; carbonate of lime, 428; whey establishment at, 439
Badenweiler, temperature and elevation, 169, 170; warm baths at, 181; a health-resort, 571
Bagnères de Bigorre, springs at, 171
Bagnères de Luchon, salts in springs, 268; sulphuretted hydrogen in piscines, 279; sulphur-baths at, 283; analysis of waters, 420
 Balneotherapy, definition and history of, 1; general, 9; method of, 613 *et seq*
Baltic Sea, chlorine combinations in, 257; watering places on coast of, 265
Barèges, use of waters after gunshot fracture, 245; salts in waters, 268; sulphur-baths at, 282; analysis of waters, 420
 Barègine, 283, 354
 Baring's experiments on carbonic acid, 36
 Barometer, influence of variations of, 48, 253
Barfild, carbonic acid in waters, 316; iron-springs at, 465, 468
 Basedow's (Graves's) disease, use of iron in, 458, 484

BAT

- Bath*, warm springs at, 170, 181; use of waters in cases of gunshot fracture, 245
- Baths, choice of season for, 45, 613 *et seq.*; general effect of, 77, 93; absorption of water, &c., 78; medium temperature of, 93; use of, in phthisis, 554; time for, 622; rest after, 624; duration of, 625; combined with courses of waters, 627; duration of course, 629
- Baths, alkaline, 301
- Baths, cold. *See* Cold baths.
- Baths, gaseous thermal, of Rehme and Naheim, 235. *See* Naheim and Rehme
- Baths, mineral, 193
- Baths, moor or mud, 295. *See* Moor-baths
- Baths, pine-leaf, 305
- Baths, sea, 252. *See* Sea-bathing
- Baths, sool, 194. *See* Sool-baths
- Baths, steel, 303. *See* Steel-baths
- Baths, sulphur, 266. *See* Sulphur-baths
- Baths, warm. *See* Warm-baths
- Battaglia*, sulphur-thermæ at, 292
- Bauer's observations on condensed air, 50
- Beatenberg*, a health-resort, 587
- Beaumaris*, a sea-bathing place, 263
- Belalp*, summer residence for invalids on, 586
- Belgian sea-bathing places, 264
- Ben Rhydding*, cold water establishment at, 122
- Bencke, Dr., on sea-air and mountain-air, 61; on the milk-cure, 434
- Berka*, artificial sand-baths at, 189
- Bernine Pass*, summer residence for invalids on, 586
- Bertrich*, temperature and elevation, 169, 170; carbonic acid in waters, 316; chloride of sodium in, 329; analysis of waters, 363; Glauber's salt-waters of, 382
- Berzelius, influence of his discoveries on balneotherapy, 5, 11
- Beulah spa bitter waters, 360
- Beur*, sool-baths at, 226; grape-cure at, 443; a health-resort, 610
- Biarritz*, a sea-bathing place, 265
- Bidder and Schmidt's researches on effect of water, 65, 67
- Bile, secretion of, increased by use of water, 67; by alkalies, 337
- Bilin*, use of waters of, in gravel, 76, 326; in gout, 139; carbonic acid in waters, 315, 330; chloride of sodium in, 329; used in vesical catarrh, 330, 370; in diabetes, 341, 366; soda-spring at, 346; carbonate of lime in, 428; iron in waters, 464

BOU

- Birmensdorf*, bitter water of, 360
- Bischof's researches on urea, 5
- Biskra*, baths of, 183
- Bitter spring at Rehme, 249
- Bitter waters, carbonic acid in, 316; use of, 358; analyses of, 359
- Bittern, 207
- Bladder, paralysis of, cold-water treatment in, 118, 155; catarrh of, use of soda-water in, 330; of Glauber's salt water, 370; summary of treatment of catarrh, 492
- Blankenberghe*, a sea-bathing place, 264
- Blankenburg*, pine-wood bath establishment at, 306
- Bleeding, uterine, use and misuse of iron in, 459
- Blood, carbonic acid in, 35; formed more richly in winter, 44; influence of water in, 64 *et seq.*; principal vehicle of animal heat, 85; effect of abnormal increase of heat in, 87; use of soda in, 320; of chloride of sodium, 385; effect of iron in, 446; effect of atmospheric pressure on gases of, 575, 576
- Blood-vessels, effect of cold bath on, 94, 96; of warm baths, 130
- Boeklet*, carbonic acid in waters, 316; sulphates of soda and magnesia in, 356; carbonate of lime in water, 428; iron spring at, 465, 469; elevation of, 466
- Body, heat of. *See* Heat, animal
- Bognor*, a sea-bathing place, 262
- Bolechow*, sool-baths at, 217
- Boll*, sulphur-bath at, 290
- Bonchurch*, a health-resort, 600
- Bones, diseases of, use of thermal sool-baths in, 206, 244; of common-salt-waters, 400; summary of treatment of, 493
- Boppard*, cold water establishments near, 120
- Bora wind in Italy, 537, 538
- Borkum*, a sea-bathing place, 264
- Bornio*, warm springs at, 170, 174; a health-resort in phthisis, 581
- Borsék*, carbonic acid in springs of, 316; carbonate of lime in, 333, 428
- Boulogne*, a sea-bathing place, 265
- Bourbonne-les-Bains*, sool-baths at, 204, 215; chlorine combinations, 210; 334, 402; use of waters after gunshot fractures, 245; carbonic acid in, 432; common-salt springs, 412; sulphate of lime in, 427
- Bourboule (la)*, soda-springs at, 355; arsenic in, 480

BOU

- Bournemouth*, a sea-bathing place, 262; a resort in phthisis, 569
- Bowels*, rheumatism of, 141; sluggishness of, carbonic acid indicated in, 312; chronic catarrh of, use of mineral waters in, 335, 370; effect of chloride of sodium on, 388, 389; use of common salt-water in chronic catarrh of, 395; effect of iron on, 448; summary of treatment of, 491; use of iron in atony of, 460
- Bozen*, grape-cure at, 443; a health-resort, 608
- Brain*, change of action of, by travelling, 19; treatment of exhaustion of, 151; apoplexy of, 155; softening and sclerosis of, 156
- Bray*, a sea-bathing place, 263
- Breast*, tumours of, treated by warm baths, 146; by sool-baths, 207
- Breath*, shortness of, in phthisis, 515
- Brescia*, a health-resort, 541
- Bristenberg*, cold water establishment at, 121
- Bridlington*, a sea-bathing place, 262
- Brighton*, a sea-bathing place, 262
- Broadstairs*, a sea-bathing place, 262
- Bromides* in mineral waters, 205; in sool-waters, 226, 227
- Bromine* in sea-air, 255
- Bronchial catarrh*. See Catarrh of respiratory membrane
- Brotterode*, a health-resort in phthisis, 579
- Brückenau*, carbonic acid in water, 316; carbonate of lime in water of, 428; iron spring, 465, 469; elevation of, 466
- Buda*, warm iron-springs at, 303
- Budleigh Salterton*, a sea-bathing place, 262
- Builth*, sulphur-well at, 291
- Bülow spring* at Rehme, 249
- Bundoran*, a sea-bathing place, 263
- Burns*, loss of temperature in, 98
- Burtscheid*, sulphur-springs at, 286; analysis of waters, 420
- Busko*, sool-baths at, 217
- Bute*, island of, a health resort, 599
- Batter*, protection of, 30
- Buttermilk*, dietetic use of, 26
- Buxton*, use of water of, in gout, 138; warm waters of, 170, 178

CAB

- Caloric*, regulation of, 12
- Camfer*, a health-resort, 586
- Cannes*, a health-resort, 603; temperature and rain, 612
- Cannstadt*, waters of, used in scrofula, 204; chlorine combinations in, 209, 334, 402; sool-baths at, 212; carbonate of lime in waters, 334; carbonic acid in, 334, 402; temperature of waters, 335; use of soda-waters in chronic catarrh of stomach, 334, 393; in abdominal plethora, 397; in diseases of bones, 400; carbonic acid in, 316, 402; common-salt-waters at, 407; temperature of water, 403; sulphate of lime in water, 427; iron in water, 464
- Carbonate of lime*. See Lime
- Carbonate of magnesia*. See Magnesia
- Carbonate of potash*. See Potash
- Carbonate of Soda*. See Soda
- Carbonic acid*, in air, 35; effect of increased or diminished pressure on excretion of, 51, 52, 53; increased with increased production of heat, 92; effect in cold bath on secretion of, 96; in Kissingen baths, 229; in sea-air, 225; general action of, 235, 310; in sool-baths of Rehme and Nauheim, 236; baths of, 249; in alkaline springs, 302; in mineral waters, 310-316; indications for use of, 312; amount of, in various mineral waters, 315; conveyed by carbonate of soda in blood, 321; an adjuvant and corrective to bitter waters, 358; action of, in iron waters, 463; injurious in phthisis, 550
- Caries*, use of sool-baths in, 206, 244
- Carlsbad*, use of waters of, in gravel, 76, 326, 370; in gout, 117, 137, 139, 200, 327, 370, 374, 399; in ovarian tumours, 145; in rheumatism, 200; in scrofula, 203, 204, 336, 371; in lead-poisoning, 278; springs of, warm, 303; carbonic acid in waters of, 316; amount of common salt in water, 329; temperature of waters, 330; use in catarrh of cystic duct, 336; for removal of exudations, 336; effect of water on function of liver, 337; use of, in diabetes, 339, 366, 375; in abdominal congestion, 342; sulphates an essential component of waters of, 356; analysis of waters, 363, 372; use in corpulence, 366; in liver diseases, 367; in hemorrhoidal conditions, 369; in catarrh of stomach, 371, 375, 394; in chronic ulcer of stomach, 371; description

CADET de Vaux, his treatment of gout, 75

Cairo, a health-resort, 601; temperature and rain, 612

Calais, sea-bathing at, 265

Callosities, rheumatic, 144

CAS

of waters and baths, 372; in liver diseases, 374, 398; in tendency to uric acid concretions, 374; in chronic catarrh of bowels, 396; in chronic infarction of uterus, 401; carbonate of lime in waters of, 428; iron in, 464; in simple catarrh, 519
Castellamare, salt-springs at, 218
Catania, a health-resort, 607
 Catarrh of bladder, use of soda-waters in, 330, 346; Glauber's salt waters, 370; summary of treatment of, 492
 Catarrh of bowels, use of mineral waters in, 335; Glauber's salt waters, 370, 373; common-salt-waters, 396; summary of treatment of, 491
 Catarrh of cystic duct, use of mineral waters in, 335
 Catarrh of pharynx, use of sulphur-waters in, 416
 Catarrh, phthisical, 518 *et seq.*
 Catarrh of respiratory membrane, use of vapour-baths in, 186; supposed effect of carbonic acid on, 314; use of soda-waters in, 328, 345, 347, 348; Glauber's salt waters, 370, 378; common-salt-waters, 398; sulphur-waters, 415; summary of treatment of, 492
 Catarrh of stomach, use of soda-waters in, 331, 344, 352, 393; Glauber's salt waters, 370, 373; common-salt-waters, 392; summary of treatment of, 491
 Catarrh of uterus and vagina, use of soda-waters in, 331
Cauterets, sulphur-baths of, 281
 Cavities, phthisical, in lungs, 525
Celrina, a health-resort, 586
 Central paralysis, 149, 155
 Chalybeate alkaline acidulated springs, 316
 Chalybeate waters. *See* Iron-waters
 Chamounix, combustion on, 59
Champery, a health-resort, 587
 Change of substance, influence of season on, 44; of mountain-air and sea-air, 58; of water, 66; of soot-baths, 195; of carbonate of soda and chloride of sodium, 323, 387, 389
Channel Islands, a health-resort, 598
Charlottenbrunn, a health-resort for phthisical patients, 571
Cheltenham, bitter waters of, 360
 Chemical analysis, influence on balneo-therapy, 5, 11
Cherry-rock bitter waters, 360
Chiavenna, a health-resort, 610
 Child-birth, paralytic weakness after, from hæmorrhage, 150; from tedious labour, 150
 Children, heat of body in, 91; feeble

COL

resistance to cold bath in, 103; spinal paralysis of, 156
 Chlorides in various waters, 204, 206, 256, 329
 Chloride of sodium. *See* Sodium, chloride of; also Common salt-waters and Soot-baths
 Chlorosis, different forms of treatment required by, 56; form of, in Russia, 57; use of iron in, 447, 452
 Chorea, treatment of, 165
 Chronic maladies, study of the individual required in treatment of, 13; conditions of, 16
Churwalden, a health-resort in phthisis, 581
Ciechocinek, soot-baths at, 217
Cimiez, a health-resort, 605
Cinchona in tabes, 158
Clevedon, a sea-bathing place, 263
Clifton, warm baths at, 170; a health-resort, 601
 Climate, value of change of, 31; influence in relation to phthisis, 502, 531, 588; in relation to spa-treatment, 617
 Clouds, explained, 539
 Cod-liver oil, use of, 27; in tabes, 159; in phthisis, 544
Colberg, soot-baths at, 233; a sea-bathing place, 265
 Cold, extreme, effect of on animals, 94
 Cold bath, 94; elementary effects of, 94; experiments on animals, 94; effect on man, 95; on temperature, 96, 102; on secretion of carbonic acid, 96; on pulse and respiration, 96; on sensibility, 96; on skin, 96; on internal organs, 96; consequences of, 97; general character of effect, 97; physiological value of reaction after, 98; therapeutic effect of, 99; forms of, 101; differences of temperature, 101; duration of bath, 102; dimension, 102; practical maxims regarding use of, 103; rarity of colds after, explained, 105; in febrile diseases, 105; hectic fever, 106; chronic diseases, 107; metallic poisoning, 109; hypochondriasis, 109; hysteria, 110; atony of skin, 111, 142; chronic exanthemata, 112; local perspirations, 113; urticaria, 113; furunculosis, 113; psoriasis, 114; eczema, 114; prurigo, 115; pemphigus, 115; purpura, 116; gouty and rheumatic exudations, 116; rheumatism, 117, 144; paralysis, 118; impotence, 118; deficient menstruation, 119; list of bathing establishments, 119; effect compared with warm bath, 123

COL

Cold-water treatment, vapour-bath an element of, 186; in phthisis, 555. *See* Cold Bath
 Colds, origin of, 105; treatment by vapour-baths, 185. *See* Catarrh
 Collectedness of mind, by whom required, 24
Combataz, a health-resort, 586
 Combustion in rarefied air, 59; source of animal heat, 88
 Common-salt-waters, use of in hysteria, 111; in scrofula, 203; carbonic acid in, 316; chapter on, 384; use of in dyspepsia and catarrh of stomach, 391; in chronic ulcer of stomach, 395; in chronic catarrh of bowels, 395; in abdominal plethora, 396; in liver-disease, 397; in enlargement of spleen, 398; in bronchial catarrh and tubercles in lungs, 398; in gout, 399; in diseases of bones, 400; in scrofula, 400; for removal of exudations, 400; enumeration of, 401
 Compensation, power of, a factor in health, 12
 Concussion, paralysis from, treated by hot baths, 152
 Condensed air. *See* Air, condensed
 Consumption, chronic pulmonary, balneotheopathy and climatotherapy of, 489. *See* Phthisis
 Contagion of phthisis, 506
 Contractions, muscular, in paralysis, 155
 Convalescence, difficult, use of warm baths in, 132; of sool-baths, 134, 241; iron-waters in, 456; summary of treatment of, 482
 Corpulence, combined with muscular rheumatism, treatment by warm baths, 143; treatment by Glauber's salt waters, 365
Costebelle, a health-resort, 693
 Cough and expectoration in phthisis, 508
 Country air as a remedy, 31. *See* Air
Cove, a health-resort, 598
Cowes, a sea-bathing resort, 262
Cranz, a sea-bathing place, 265
Crieff, cold-water establishment at, 122
Cromer, a sea-bathing resort, 262
Cronthal, sool-baths at, 213; carbonic acid in waters of, 316, 334, 402; chlorine compounds in, 209, 334, 393, 402; waters of in dyspepsia, 392; in abdominal plethora, 397; in diseases of bones, 400; common-salt-waters of, 408; bicarbonate of iron in, 464
 Crowded rooms, injurious influence of, 36
 Crusta lactea, use of sool-baths in, 198
Cudowa, carbonic acid in waters of,

DRI

316; chloride of sodium in, 329; carbonate of lime in, 428; iron-waters of, 465, 469; height above sea, 466; arsenic in water, 480
Curria, his use of cold water in fevers, 4, 94
Cushaven, a sea-bathing place, 264
 Cystic duct, catarrh of, 335

DAGSHAI, a health-resort in India, 587
Dangast, a sea-bathing place, 264
Davos am Platz, Dr. Frankland on air at, 61; a health-resort in phthisis, 582; temperature, 612
Davos Doifli, a health-resort, 584
 Davy, Sir H., effect of oxygen on functions of life, 51; researches on flame, 60
Dawlish, a sea-bathing place, 262; a health resort, 598
Deal, a sea-bathing place, 262
 Decomposition, products of, in air, 34
 Development, imperfect, use of sool-baths in, 241
 Diabetes, greater and lesser forms of, 338; Carlsbad and Vichy waters in, 339, 366, 375; summary of treatment of, 493
Dieppe, a watering place, 265
 Diet, alteration of, combined with travel, 27; general rules for, impossible, 28; prejudices regarding, 29; regulation of, 628; water as an article of, 63; in phthisis, 543
Dirtenmühle, a cold-water establishment, 120
 Dietetic treatment, three kinds of, 26
Dievenow, a sea watering place, 265
 Diffuse catarrhal phthisis, 522
 Digestion, action of water in, 68; effect of carbonate of soda on, 323; of chloride of sodium, 388
 Diphtheritic paralysis, use of warm baths in, 163, 497
 Diseases, effects of medicinal springs on, 9, 384
 Diuretic action of water-drinking, 66, 72; of carbonate of soda, 324
 Diversion of mind, 20, 24
 Diving-bell, observations in the, 50
Doberan, a sea-bathing place, 265
 Douches, mechanical effects of, 190; cold, 191; warm, 191; mixed or Scottish, 192; in phthisis, 554
Dover, a sea-bathing place, 262
Dovercourt, a sea-bathing place, 262
Dresden, artificial sand-baths in, 189
Driburg, moor-baths at, 300; carbonic

DRI

- acid in waters of, 316; sulphates in waters of, 356, 427; carbonate of lime in waters, 428; iron-waters at, 465, 470; height of, 466; arsenic in water, 480
 Drink, cool, effects of, 91
 Drinking courses of medicinal waters, 307
 Dropsy, treatment by warm baths, 146
 Drunkards, trembling of, treatment by baths, 165
Druskienniki, sool-baths at, 217
 Dryness of air, 574
Duncannon, sea-bathing at, 263
Dürkheim, chlorides in sool. waters, &c., of, 204, 206, 208, 209, 210, 402; iodine and bromine in, 205; sool-baths at, 232; carbonic acid in springs, 316, 402; common-salt-waters of, 409; grape-cure at, 443; bi-carbonate of iron in water, 464
 Dust, organic, in air, 33
Düsterbrook, sea-bathing at, 265
 Dynamic paralysis, 149
 Dyspepsia, use of soda-waters in, 333, 344; use of common-salt-waters in, 391

- E**ARTHY mineral waters, 422; carbonic acid in, 316; quantity of salts in, 425; enumeration of, 429
Eastbourne, a sea-bathing place, 262
Eaux-Bonnes, sulphuretted hydrogen in, 268; sulphur-baths of, 280; a health-resort, 580
Eaux-Chaudes, sulphur-baths of, 281; analysis of, 420
 Eczema, treatment by baths, 114, 198; by sool-baths, 248
Elenkohen, grape-cure establishment at, 443
 Effervescent soda-powder, effect of, 312
Engishorn, summer residence for invalids on, 586
Egypt as a health-resort in phthisis, 602
Évian, sulphuretted hydrogen in waters, 268, 272; salts in, 268; sulphur-baths at, 289; moor-baths at, 300; analysis of waters, 420; sulphate of lime in, 427; carbonate of lime in, 428
Eisenach, pinewood-baths at, 306
 Electricity, in air, 42; use of in hemiplegia, 155; in spinal paralysis of children, 157; in tabes, 159
 Elevated health-resorts, 571
Elisen spring, use of in scrofula, 205
Elmen, sool-steam-baths at, 166, 249; chlorides in mother-lye of, 209; sool-baths at, 233; sulphate of lime in waters, 427

EXU

- Elöpatak*, or *Arapatak*, 466
Elster, waters of in gout, 139; moor-baths at, 300, 381; carbonic acid in waters, 316; common salt in waters of, 329; analysis of waters, 363, 381; Glauber's salt waters of, 381; use of in catarrh of stomach, 394; carbonate of lime in waters, 428; carbonate of iron in waters, 464; elevation of, 466; lithia in water, 479
 Emaciation, use of baths at Rehme and Nauheim in, 241; Glauber's salt waters in, 363; in phthisis, 514
 Emphysema, increase of temperature prevented by, 92; alleged immunity from phthisis, 505
 Empiricism in balneotherapy, 3
Ems, use of waters in gout, 139; carbonic acid in waters of, 302, 316; common salt in waters of, 329, 350; temperature of water, 329; soda-spring at, 353; use of waters in catarrh of stomach, 394; carbonate of lime in waters, 428; whey establishment at, 439; carbonate of iron in waters, 464
Engelberg, cold water and whey establishment, 121, 440; a health-resort in phthisis, 581
Enghien, sulphur-spring at, 285
 Epilepsy, baths not useful in, 166, 495
Epsom, well at, 360
 Erethic phthisis, 513, 589
 Essential paralysis, 156
Éretat, sea-bathing at, 265
Euganean thermæ, 292; moor-baths at, 300
 Evacuations, alvine, effect of bodily exercise on, 25
Evian-les-Bains, alkaline spring at, 349
 Exanthemata, chronic. *See* Skin, diseases of
 Excito-caloric nerve-system, 90
 Exercise, effects of, 25, 67; in phthisis, 547, 562
 Exophthalmic goitre, treatment of, 458, 484
 Expectoration in phthisis, 508; increase of by use of springs, 551; diminution of, 661
 Exudations, gouty, cold-water treatment generally contraindicated in, 116; use of warm baths for removal of, 138, 176; use of sulphur-baths, 274; mud-baths, 295. *See* Gout
 Exudations, scrofulous, treatment of by baths, 144; sool-baths in, 202; use of Carlsbad waters in, 371; common-salt-waters in, 400

EXO

Exudations, various, sool-baths in, 206 ; use of soda-waters in, 336 ; chloride of sodium present in, 385 ; summary of treatment of, 493

FACHINGEN, soda-waters of, 346 ; carbonic acid in, 315 ; common salt in, 329 ; use of in vesical catarrh, 330, 370 ; in diabetes, 341, 366 ; in catarrh of stomach, 394 ; carbonate of lime in waters, 428 ; bicarbonate of iron in, 464

Falkenstein, a health-resort, 406, 558

Fascial rheumatism, 140

Fattening cures in phthisis, 544

Fécamp, sea-bathing at, 265

Feet, treatment of perspiration of, 113

Fellakthal spring, carbonic acid in, 315 ; common salt in, 329 ; soda-waters, 347 ; carbonate of lime in, 428 ; iron in, 464

Felsenegg, cold water and whey establishment at, 121

Fever, source of heat in, 89 ; application of cold in, 94, 98, 105, 555 ; effect of cold bath in, 103 ; accompanying phthisis, 511 ; in pneumonia, 523

Fibrine of blood held in solution by carbonate of soda, 321

Filey, sea-bathing at, 262

Fleetwood, sea-bathing at, 263

Flinsberg, carbonic acid in waters, 316 ; iron-waters at, 465, 470 ; height of, 466

Floyer, founder of doctrine of balneotherapy, 4

Fluor albus, treatment of, 331

Föhn wind, 538, 582

Folkestone, sea-bathing at, 262

Food, *See* Diet

Forces, physical, compensation of, 40

Formic acid in moor-baths, 298

Forres, cold-water establishment at, 122

Frankenhausen, sool-baths at, 231

Frankland, experiments on combustion, 59 ; on air at Davos, 61

Franezensbad, use of waters of in gravel, 76 ; in gout, 139 ; moor-baths at, 300 ; carbonic acid in waters of, 316 ; common salt in waters, 329 ; analysis of waters, 363 ; iron in water, 372, 464 ; Glauber's salt waters of, 378 ; use in removal of exudations, 401 ; carbonate of lime in, 428 ; height of, 466

Freienwalde, iron-waters at, 465, 470

Freiersbach, iron-waters at, 465, 467, 468 ; height of, 466

Friction, cold, in tabes dorsalis, 159

Friedrichshall, carbonic acid in waters,

GLE

316 ; bitter waters of, 359 ; sulphate of lime in waters, 427

Friedrichsrode, pine-leaf baths at, 306 ; a health-resort, 570

Frohnalp, a health-resort, 586

Fruit-cure, effect of, 27

Funchal, a health-resort, 593

Furunculosis, treatment by baths, 113

Füred, carbonic acid in water of, 316 ; common salt in, 329 ; analysis of water, 363 ; Glauber's salt waters of, 382 ; carbonate of lime in waters, 428 ; iron in, 464

GAIS, whey establishment at, 440 ; a health-resort, 587

Gallstones passed during use of alkaline waters, 367 ; use of Apollinaris water in tendency to, 347 ; of Carlsbad waters, 374

Gaseous springs, 315

Gases in air, 34 ; absorption of by skin, 78 ; in moor-baths, 298 ; of blood and lymph, effect of decreased atmospheric pressure on, 576

Gas-baths at Rehme, 219

Gastein, use of waters of in gout, 139 ; in tabes, 160, 161 ; indifferent thermal baths of, 168, 175 ; temperature of baths, 169 ; elevation, 170 ; use of baths after gunshot fractures, 245

Gastralgia, use of Carlsbad waters in, 373

Geilnau, carbonic acid in waters, 315 ; common salt in, 329 ; soda-springs at, 347 ; carbonate of lime in waters, 428 ; iron in, 464

Gersau, a health-resort, 610, 611

Giessbach, a health-resort in phthisis, 587

Gieshübel, common salt in water, 329 ; soda-spring at, 347 ; carbonate of lime in, 428 ; iron in, 464

Girls, peculiar disease of in Russia, 57

Glaciers, influence of air of, 573

Glauber's salt, discovery of, 2 ; physiological effect of, 356 ; waters containing, 359, 362, 372 ; use of waters in corpulence, 365 ; in diabetes, 366, 375 ; in liver-diseases, 367 ; in hæmorrhoidal conditions, 368 ; in catarrh of respiratory organs, bladder, stomach, 370, 373, 378 ; in gout and gravel, 370, 374 ; in ulcer of the stomach, 371 ; in serofulous exudations, 371

Gleichenberg, carbonic acid in water of, 316 ; common salt in, 329, 350 ; soda-waters at, 352 ; use of in catarrh of stomach, 394 ; carbonate of lime in, 428 ; iron in, 464 ; a health-resort in phthisis, 567

GLE

- Gleisweiler*, cold-water establishment at, 121; whey and grape cures at, 440, 443
- Glion*, a health-resort in phthisis, 587
- Gnadenwald*, sool-baths at, 225
- Goczalkowitz*, sool-baths at, 228
- Godesberg*, cold-water establishment at, 120; iron-waters, 465, 470
- Goitre, exophthalmic, use of iron in, 458, 484
- Gonten*, iron-water, 465
- Goose-skin produced by cold bath, 96
- Görbersdorf*, a health-resort, 578
- Gout, use of water in, 74, 116; warm baths in, 136; sool-baths in, 200, 242; sulphur-baths in, 274; carbonate of soda in, 326; soda-waters in, 326, 346, 347, 352; Carlsbad waters in, 374; common-salt-waters in, 399; summary of treatment of, 487
- Gräfenberg*, cold-water establishment at, 121
- Gran*, sulphate of lime in waters, 426
- Grange*, a health-resort, 601
- Grape-cure, action on blood, 27; description and use of, 441; establishments, 443; use of in catarrh, 519
- Gravel, use of water in, 75; use of soda-waters, 325, 346, 347; use of Glauber's salt waters, 370, 374
- Graves's disease, use of iron in, 458, 484
- Gries*, a health-resort, 608
- Griesbach*, iron in waters, 465; height of, 466; analysis of waters, 468
- Grosswardein*, sulphur-baths at, 294; analysis of waters, 420; carbonate of lime in waters, 428
- Grünberg*, grape-cure establishment at, 443
- Grund*, a health-resort in phthisis, 570
- Gunshot fractures, use of mineral waters after, 245
- Gurnigel*, sulphur-bath at, 290
- Gutike, Dr., on change of air, 31
- Gutiguelle*, a strong sulphur-spring, 421
- Gymnastics in hypochondriasis, 110; in hysteria, 111; pulmonary, in phthisis, 551

HEMOPTYSIS, effect of baths on, 554

- Hæmorrhoidal conditions, use of water in, 76; types of, and their treatment, 368
- Hæmorrhoidal tabes, treatment of, 160
- Hahn, on cold frictions in typhus, 4
- Hall* (Austria), sool-baths at, 224; chlorine compounds in water, 204, 206, 210, 402; iodine compounds in, 205; carbonic acid in waters, 316, 402;

HOF

- common-salt-waters of, 400; iron in waters, 464
- Hall* (Tyrol), sool-baths at, 224
- Hall* (Württemberg), sool-baths at, 229
- Hammam Meskoutin* (or Meskhrouitin), warm baths at, 183
- Harkany*, sulphur-baths at, 294; analysis of waters, 420; carbonate of lime in waters, 428
- Harmattan wind, 537
- Harrogate*, salt baths at, 217; sulphur-springs, 291; iron-waters of, 464, 465, 471; elevation of, 466
- Harzburg*, sool-baths at, 228
- Hastings*, sea-bathing at, 262; a health-resort in phthisis, 600; rain at, 612
- Hauterive*, cold springs of, 344
- Havre*, a sea-bathing place, 265
- Health, the result of agents of organic life, 12; relative, 15
- Health-resorts in phthisis, 567; elevated, 571; climatic, 588; moist with equable temperature, 593; drier, 601; indifferent, 610; table of, 612
- Heart-disease, alleged immunity from phthisis, 505
- Heat, animal, theories and facts concerning, 84; blood the principal vehicle of, 85; sources of, 85; loss and increase of, 86; relation to temperature of air, 87; abnormal increase of, 87; in fever, 89; regulation of, 89; changes under certain conditions, 91; influence of cold bath on, 95, 102; of warm bath, 123; effect of exercise and rest on, 576
- Hebra, his treatment of skin-diseases, 112; of psoriasis, 114; of prurigo, 115; of pemphigus, 116; of purpura, 116; on use of sulphur, 147, 271, 273
- Hectic fever, treatment of, 106
- Heiden*, cold-water establishment at, 121; whey establishment at, 440; a health-resort in phthisis, 587
- Heligoland*, sea-bathing at, 264
- Helonau*, sulphur-springs at, 294
- Hemicrania, sea-bathing in, 260, 495
- Hemiplegia, prognosis and treatment of, 155, 497
- Heppinger*, soda-spring, 349
- Hereditary disposition in phthisis, 502
- Heringsdorf*, a sea watering place, 265
- Herrenalb*, cold-water establishment at, 121
- Hervier and St. Lager, observations with pneumatic apparatus, 51
- Heustrich*, sulphur-bath, 290
- Himalayas, Schlagintweit's observations on, 55
- Hofgastein*, warm baths at, 177

HOF

- Hofgeismar*, pine-leaf baths at, 306; iron in waters, 465; height of, 466; iron-waters at, 471
- Homburg*, chlorine compounds in waters of, 210, 334; sool-baths at, 214; analysis of waters, 251; carbonic acid in waters of, 316, 334, 402; carbonate of lime in waters, 334; use of waters in dyspepsia, 392; in abdominal plethora, 396, 397; in diseases of bones, 400; common-salt-waters of, 403; a resort in simple catarrh, 519
- Hoppe, observations on animals under air-pump, 52
- Horses, treatment of diseases of, at Cauterets, 282
- Hot baths, indications for, 130
- Hotel Alpen Club*, a health-resort in phthisis, 587
- Hotel Arenstein*, a health-resort, 587
- Hotel Monte Generoso*, a health-resort, 586
- Hotel Stossberg*, a health-resort, 586
- Hubertusbad*, cold-water establishment at, 121; sool-baths at, 228
- Humoral pathology in chronic diseases, 14
- Hunyadi Janos* bitter waters, 359
- Hydrotherapy, the foundation of doctrine of mineral baths, 78; selection of cases for, 99; influences of, 108. *See* Cold Baths, and Water
- Hyères*, climate of, 540; a health-resort, 603; temperature and rain at, 612
- Hyperæsthesia, treatment by warm baths, 165; by moor-baths, 295
- Hypochondriasis, treatment of, 109, 494; warm baths in, 176
- Hysteria, pathology and treatment of, 110, 494; warm baths in, 176; caution against misuse of iron in, 461
- Hysterical cough, characters of, 508
- Hysterical paralysis, cold-water system sometimes useful in, 118; treatment of, 152; thermal sool-baths in, 247; summary of treatment of, 495
- Hysterical tabes, 158

ICTERUS, catarrhal, treatment by alkaline waters, 367; by common-salt-waters, 397

- Ilfracombe*, a sea-bathing place, 263
- Ilkley Wells*, cold-water establishment, 122
- Ilmenau*, cold-water establishment at, 120; pine-wood-baths at, 306
- Isenburg*, pine-leaf-baths at, 306
- Ismanau*, carbonic acid in waters of, 316 carbonate of lime in, 428; iron in,

JUL

- 465; height of, 466; iron-waters of, 471
- Impetigo, treatment of, 198
- Impotence, cold baths in, 118; warm baths in, 152; effect of Gastein in, 176
- Inanition, effect of supply of water in, 65
- Indifferent temperature of baths, 129; thermal baths, 143, 166; health-resorts, 610
- Individual, the, to be considered in chronic maladies, 13
- Inhalations in phthisis, 551; apartments for, 553
- Inselbad*, alleged excess of nitrogen in waters, 317; sulphate of lime in water, 427; carbonate of lime in, 428; earthy mineral waters, 432; a resort in phthisis, 557
- Interlaken*, whey-establishment at, 440
- Internal organs, effect of cold bath on, 96
- Iodide of potassium in tabes, 159
- Iodine, treatment of scrofula by, 205, 244; in sea-air, 255
- Iron in retarded convalescence, 134; in tabes, 158; conditions of effect of, 445; effect on blood, 446; on stomach and bowels, 448; on pulse and heat, 449; dose of, 449; principles of use of, 450; in mineral waters, 464
- Iron-waters, use of in hypochondriasis, 110; carbonic acid in, 316; chemical state of iron in, 444; use of in chlorosis, 452; in anæmia, 455; in anomalies of menstruation, 458; in atony of stomach, 460; in neuroses, 460; chemical constitution of, 461; compound, 464; pure, 465; list of, 466
- Ischia*, hot springs of, 216
- Ischl*, sool-steam-baths of, 186; chlorine in sool, 208; sool-baths at, 225; whey-establishment at, 439; iron in waters, 464
- Itch, treatment by sulphur, 274
- Iwanda*, sulphate of lime in water, 427
- Iwonicz*, chlorine compounds in waters, 210, 402; sool-baths at, 216; carbonic acid in waters, 316, 402; common-salt-waters of, 405

JAUJA, a health-resort, 587

- Jaxfeld*, chlorine compounds in waters, 209; sool-springs at, 229
- Jersey*, a health-resort, 598
- Johannisbad*, thermal baths of, 170, 181
- Johannisberg*, cold-water establishment, 120
- Joints, inflammation of, treated by sool-baths, 206, 244. *See* Rheumatism
- Juliushall*, sool-baths at, 228

KAI

- KAINZENBAD**, soda-springs at, 354 ; sulphur-spring at, 421 ; a health-resort in phthisis, 580
Kaiserquelle, at Aix-la-Chapelle, 286
Karner, classification of warm baths, 129
Kassauli, a health-resort, 587
Kilburn bitter waters, 360
Kilkee, a sea-bathing place, 263
Kissingen, sool-spray-baths at, 186 ; chlorine compounds in springs, 204, 210, 334, 393, 402 ; sool-baths at, 227 ; analysis of waters, 251 ; carbonate of lime in, 333 ; carbonic acid in, 334, 402 ; bitter waters of, 360 ; compared with Wiesbaden, 390 ; use of waters in dyspepsia, 392 ; use in abdominal plethora, 396 ; common-salt-waters of, 403 ; sulphate of lime in waters, 426 ; bicarbonate of iron in, 464 ; arsenic in, 480 ; use in simple catarrh, 519
Klosters, a health-resort, 586
Knibis baths, 467
Königsbrunn, cold-water establishment at, 121
Königsdorf-Jastrzemb, sool-baths at, 228
Königswarth, iron-springs at, 465, 471
Kösen, sool-baths at, 232
Köstritz, sand-baths at, 189 ; sool-baths, 232
Koumiss, use of in phthisis, 545
Krankenheil, iodide of sodium in water, 205
Krause, experiments on absorption by skin, 78
Kreuth, sool-baths at, 223 ; analysis of sulphur-spring, 420 ; whey establishment at, 439 ; a health-resort in phthisis, 581
Kreuznach, sool-steam-baths at, 186 ; chlorine compounds in water, 204, 206, 208, 210, 402 ; iodine and bromine in, 205 ; sool-baths at, 218 ; indications for use of, 220 ; analysis of waters, 251 ; use of in scrofula, 400 ; carbonic acid in, 402 ; common-salt-waters of, 410 ; grape-cure establishment at, 443 ; iron in waters, 464
Kronthal. See Cronthal
Krynica, carbonate of lime in water, 428 ; iron spring at, 471

- LABRADOR**, effect of climate of in phthisis, 533
Landeck, temperature and elevation of baths, 169, 170 ; warm baths at, 179 ; sulphur-baths, 288

LIP

- Langenbrücken**, sulphuretted hydrogen and salts in, 268 ; sulphur-springs, 289 ; carbonic acid in waters, 316 ; analysis of waters, 420
La Porretta, salt springs of, 218
Laublach, cold-water establishment at, 119
Lauterberg, cold-water establishment at, 121
Lavey, thermal sulphur-spa at, 288
Lead, use of sulphur-bath in poisoning by, 276
Leamington, sulphated waters at, 361
Le Cannet, a health-resort, 604
Lehmann, variations in atmospheric pressure, 54 ; use of cutaneous transpiration, 82
Le Prése, a health-resort in phthisis, 581
Leste wind, 537, 538
Leucorrhœa, cold-water treatment in, 119
Leukerbad, temperature and elevation of baths, 169, 170 ; warm baths at, 172 ; carbonate of lime in waters, 333, 428 ; sulphate of lime in, 427 ; earthy waters of, 430
Liebenstein, cold-water establishment at, 120 ; pine-leaf baths at, 306 ; carbonate of lime in waters, 428 ; whey establishment at, 439 ; iron waters of, 465, 471 ; height of, 466
Liebnzell, temperature and elevation of baths, 169, 170 ; warm baths at, 180
Liebermeister's theory of regulation of animal heat, 89
Liebig's view on tissue-change, influence on balneotherapy, 5 ; on respiration in condensed air, 50, 51 ; theory of action of sulphates, 309
Liebwärda, carbonic acid in waters, 316 ; carbonate of lime in, 428 ; iron waters of, 465, 472 ; height of, 466
Life, conditions of, in relation to health, 15
Light, physiological influence of, 46
Lime, theory of effect of, 422 ; sources of supply, 423 ; treatment of rachitis and osteomalacia by, 424 ; limited therapeutic use of in waters, 425 ; use of in phthisis, 549
Lime, carbonate of, in mineral waters, 333, 427
Lime, sulphate of, in sea-water, 256 ; interferes with action of sulphur-waters, 418 ; in mineral waters, 426
Lippspringe, carbonic acid in waters, 316 ; nitrogen in, 317 ; carbonate of lime in, 333, 428 ; sulphate of lime in, 427 ; earthy waters of, 432 ;

LIS

- use of in pleuritic exudations, 518;
a resort in phthisis, 521, 555
Lindunvarna, sulphur-baths at, 292
Lithia, minimal amount of, 478
Lithic acid diathesis, Apollinaris waters
in, 367; Carlsbad water in, 374. *See*
Gravol
Littlehampton, a sea-bathing place, 262
Liver, effect of water on secretion by, 67;
effect of carbonate of soda and alka-
lies, 337; enlargement of, soda-waters
in, 344, 352; Glauber's salt waters in
diseases of, 367; Carlsbad water in
enlargement of, 374; common salt
waters, 397; sulphur waters, 416
Lixivation of blood and tissues by
water, 65
Llandrindod, sulphur-wells at, 291
Llandudno, a sea-bathing place, 263
Llanwrtyd, sulphur-wells at, 291
Lobenstein, iron-waters of, 465, 472;
height of, 466
Lobular pneumonia, 523
Loèche-les-Bains. *See* Leukerbad
Lowestoft, a sea-bathing place, 262
Lubin, sulphuretted hydrogen and salts
in waters, 268; sulphate of lime in,
427; carbonate of lime in, 428
Lucca, warm baths at, 171, 182
Luchon. *See* Bagnères de Luchon
Ludwig on loss of moisture from lungs,
41
Ludwigsbrunnen, use of, 404
Luquano, a health-resort in phthisis, 609
Luhatschowitz, carbonic acid in waters,
316; common salt in, 329, 350; use
of waters in diabetes, 341; soda-
waters of, 351; waters of used in
catarrh of bladder, 370; in catarrh
of stomach, 394; carbonate of lime
in water, 428; bicarbonate of iron in,
464
Luisenbrunnen, useful in anæmia, 404
Lungs, influence of moisture of air on
exhalation of water from, 39; influ-
ence of density of air on, 48
Luxeuil, warm baths at, 171, 182
Lynmouth, a sea-bathing place, 263
- MACPHERSON**, Dr. J., his work on
mineral waters, 291
Madeira, a health-resort in phthisis,
593; temperature and rain at, 612
Magnesia, carbonate of in mineral wa-
ters, 427
Magnesia, sulphate of, in sea waters,
356; waters containing, 359
Mallow, warm baths at, 160
Maloja, the, a health-resort, 583

MET

- Malvern*, cold-water establishment at,
122
Marchand on oxygen in the body, 51
Margate, a sea-bathing place, 262
Mariabad, moor-baths at, 300; car-
bonic acid in waters, 316; use of
waters in gout, 327, 370; in catarrh
of respiratory membrane, 329, 370; in
chronic catarrh of bowels, 336; in
congestion of abdominal organs, 342,
396; sulphates of soda and magnesia
in waters, 356; analysis, 363; use of
waters in corpulence, 366; Glauber's
salt waters of, 375; use in catarrh of
stomach, 394; carbonate of lime in
waters, 428; iron in, 464; a health-
resort in catarrh, 519
Marienbergr, cold-water establishment
at, 119
Marienlyst, a sea-bathing place, 265
Martioz, sulphur-springs of, 285
Mallock, cold-water establishment at,
122
Meals, rules concerning, 28
Mechanical employments, supposed
mental effort in, 23
Mediterranean Sea, percentage of chlo-
rine compounds in, 257; bathing-
places, 265
Mehadia, sulphuretted hydrogen in wa-
ters, 268; chlorine compounds in
waters of, 268, 419; sulphur-baths
of, 293; analysis of waters, 420
Meinberg, sulphur-baths at, 290; moor-
baths at, 300; carbonic acid in waters
of, 316
Meningitis, spinal, progress and treat-
ment of, 161; acute, treatment by
sool-baths, 246; summary of treat-
ment of results of, 497
Menstruation, temperature during, 91;
cold baths not well borne in, 103;
deficient, baths in, 118; premature,
treatment of, 459
Mental and physical activity, relations
of, 22
Mentone, a health-resort, 605; tempera-
ture and rain, 612
Meran, whey establishment at, 439;
grape-cure establishment at, 443; a
health-resort in phthisis, 607; tem-
perature and rain, 612
Mergentheim, chlorides in waters, 204,
210, 334, 402; carbonic acid in, 316,
334, 402; use of waters in catarrh of
stomach, 334; bitter waters, 360;
common-salt-waters of, 406; sulphate
of lime in, 427; iron in waters, 464
Metallic poisoning, use of water-cure
in, 73, use of cold bath, 109; sulphur-

MET

- baths, 276; sulphur-waters, 417; summary of treatment of, 486
- Metritis, chronic, baths and waters in, 145
- Miasmata, specific, retention of in air, 34
- Miliary tubercles, distinct from chronic phthisis, 505
- Mind, effect of travel on, 19; paralysis of, 151
- Mineral waters, old and modern views on, compared, 2; drinking courses of, 307
- Mineral baths, general remarks on, 193
- Misdroy, a sea-watering place, 265
- Mistral wind, 539
- Mittermaier on effects of moisture in phthisis, 552
- Moffat, sulphur-spring at, 291
- Moisture in air, influence on animal organisation, 37; in phthisis, 534, 551, 589
- Mondorf, chlorine compounds in waters, 210; sool-baths at, 216; carbonic acid in water, 316; common-salt-waters at, 412; sulphate of lime in, 427; iron in, 464; arsenic in, 480
- Mont Blanc, combustion on, 59
- Monsummano, grotto of, 187
- Mont Dore, soda springs of, 343, 345; a health-resort, 581
- Monte Catini, salt-springs at, 218
- Montreux, whey-establishment at, 439; a health-resort, 610; temperature and rain, 612
- Moor or mud baths, use for removal of exudations, 138, 139, 295; in rheumatism, 143, 144; in typhoid paralysis, 164; in hyperæsthesia and paralysis, 295; in paralysis with contractions, 296; physical and chemical properties of, 297; where found, 300; at Franzensbad and Elster, 381
- Mother-lye, definition of, 207; strength of, 208; addition of to sool-baths, 210
- Motion, a source of heat, 85, 88
- Mountain air. *See* Air, mountain
- Mühlbad, cold-water establishment at, 120
- Münch, effect of carbonate of soda on uric acid, 72, 325
- Münster am Stein, chlorine compounds in sool, 208; composition of sool and mother-lye, 219
- Muriatic soda-waters, 316, 350
- Mürren, a health-resort, 586
- Muscles, oxygen absorbed by, 51; effect of cold and warm baths on, 124; state of in paralysis, 155

NIC

- Muscular motion, a source of heat, 88; rheumatism, cold-water treatment of, 117; pathology of, 140; contractions in hemiplegia, 155
- Muskau, sulphate of lime in waters of, 426; iron-waters of, 465, 472
- Myelitis, chronic, not cured by baths, 161
- Nairn, a sea-bathing place, 263
- Nassau, cold-water establishment at, 119; pinewood baths at, 306
- Nauheim, gaseous thermal sool-baths of, 235, 249; drinking wells at, 250; carbonic acid in waters, 316, 402; carbonate of lime in, 334; chlorides in, 402; common salt waters of, 405; bicarbonate of iron in, 464; arsenic in, 480. *See* Sool-baths, gaseous thermal
- Necrosis, treatment of, 206; use of sool-baths in, 244
- Nenndorf, sool-baths of, 233; sulphuretted hydrogen and salts in waters, 268; in air over springs, 269, 272; sulphur-baths, 289; moor-baths, 300; analysis of waters, 420; sulphate of lime in waters, 427; carbonate of lime, 428
- Néris, warm baths at, 171, 182
- Nervi, a winter-resort in phthisis, 606
- Nervous disorders, use of carbonic acid in, 314
- Nervous rheumatism, a vague term, 141
- Nervous source of animal heat, 89
- Nervous system, effect of cold bath on, 96; of warm bath, 129
- Nervous weakness, sea-bathing in, 260
- Neuenahr, use of waters of, in gout, 139; carbonic acid in waters, 302, 315; common salt in water, 329; temperature of waters, 329; in diabetes, 341; soda-water of, 344; a health-resort in phthisis, 567
- Neuhaus, temperature and elevation of baths, 169, 170; warm baths at, 180; sool-baths, 213; carbonic acid in waters, 402; chlorides in, 402; common-salt-waters of, 405
- Neuragoezi, a health-resort in phthisis, 557
- Neuralgia, facial, warm baths in, 166; rheumatic, vapour-baths in, 185; summary of treatment of, 494
- Neuroses, sool-baths in, 211, 247; iron-waters in treatment of, 460; summary of treatment of, 494
- Nice, mists frequent at, 540; snow at,

NIE

541; a health-resort in phthisis, 604; temperature and rain at, 612
Niederlangensau, carbonic acid in springs, 316; carbonate of lime in, 428; iron-springs, of, 465, 474; height of, 466
 Nitrogen gas in mineral waters, 317, 550
Norderney, a sea-bathing place, 264
 North Sea, chlorides in, 257; bathing places, 265
 Nursing, in phthisis, 542
 Nutrition, influence of season, 44; diseases of, 136; *see* Diabetes, Phthisis, and Scrofula; maxims of in phthisis, 543

OBBER ALAP, sulphate of lime in waters, 427

Oberselters, water of, 353

Oeynhaus n. *See* Rehme

Ofen, carbonic acid in waters, 316

Old age, heat higher in, 91; cold baths not well borne in, 103; premature, use of thermal cool-baths in, 241

Opium, dangerous in tabes, 159

Orchitis, chronic, bath-treatment of, 146

Orezza, iron-waters of, 465, 474

Organic dust in air, 33

Organic paralysis, 140, 154, 155

Ostend, a watering place, 264

Osteomalacia, treatment of by earthy mineral waters, 425

Ovarian tumours, bath-treatment of, 145; use of Vichy waters in, 344; use of common-salt-waters in, 401

Oxidation, effect of warm bath on, 124

Oxygen, use of in the body, 51; inhalation of in condensed and rarefied air, 63, 60; in sea-air, 255; diminution of in air, 573

Ozone in air, importance of, 32; in sea-air, 255

PADERBORN, rain at, 541

Palermo, snow at, 541; a health-resort in phthisis, 606; temperature, 612

Pallanza, a health-resort in phthisis, 609

Panticosa, warm baths at, 171, 182; sulphur-baths at, 281; a health-resort in phthisis, 585

Panum's observations on respiration in condensed air, 50

Paralysis, cold-water treatment in, 118; warm baths in, 146; different forms of, 118; dynamic, 149, 150; organic, 140, 154; peripheric, 149, 154, 497;

PHT

central, 149, 155; from anæmia, 150, 495; after acute illness, 150; of mind and will from exhaustion of brain, 151; hysterical, 152, 247, 495; of sexual functions, 153; reflex, 153, 496; hemiplegic, 155, 497; spinal in children, 156, 247, 496; from spinal meningitis, 161, 246, 496; diphtheritic, 163, 497; from pressure, 163, 497; from disease of spinal column, 163; peculiar form of, 164; agitated, 165, 495; treatment by thermal cool-baths, 246, 247; by sea-bathing, 260; by sulphur-baths, 275; by moor-baths, 295; typhoid, 496; rheumatic, 496; incurable forms of, 497

Paralytic thorax in phthisis, 502

Paralytic weakness, 150, 495

Paraplegia, from concussion of spinal cord, 152, 496; from acute spinal meningitis, thermal cool-baths in, 246

Parent-Duchatelet, observations on air of drains, 269

Pathology, general, lessons of required in treatment of chronic disease, 13

Pau, rain at, 540, 612; a health-resort in phthisis, 594

Pegli, a health-resort in phthisis, 606

Pemphigus, treatment of, 116

Pennance Mawr, a sea-bathing place, 263

Penticouse. *See* Panticosa

Penzance, climate of, 263; a health-resort in phthisis, 598

Pericistitis, use of cool-baths in, 206

Peripheric paralysis, 149, 154, 497

Perspiration, effect of water-drinking on, 67; production of before cold bath, 107; local, treatment of, 113; hectic, in phthisis, 513

Petersthal, carbonic acid in waters, 316; common salt in, 329; carbonate of lime in, 333, 428; iron-waters of, 465, 467; elevation of, 466; arsenic in water, 480

Pfäfers, use of waters for gouty exudations, 138; height of, 139, 169; temperature of, 169, 170; warm baths of, 174

Phthisical constitution, thermal cool-baths in, 242; conformation, 501; disposition, 516

Phthisis, sea-bathing in, 259; Salzbrunn as a resort in, 348; Ems contraindicated in, 354; sulphur-waters in, 415; Dr. Rohden on balneotherapy and climatotherapy of, 498; disposition to, 500, 516; hereditaryness, 502; influence of age, 502; of climate, 502; alleged immunity of places from, 503; alleged immunity of

PHY

heart-disease and emphysema, 505; difference from miliary tuberculosis, 505; contagious character of, 506; anatomy and physiology of, 507; cough and expectoration, 508; fever, 511; perspiration, 513; emaciation, 514; shortness of breath, 515; typical cases of chronic, 516; apex-catarrh in, 519; diffused catarrhal, 522; pneumonic processes, 524; quiescent conditions with destruction of tissue, 525; general view of, 526; prognosis, 528; climatology applied to, 531; influence of temperature, 533; of moisture of air, 534; of atmospheric pressure, 536; of combinations of heat, moisture, and pressure, 536; residence for patients, 542; diet, 543; use of wine, koumiss, &c., 545; choice of physician, 546; social relations, 547; bodily exercise, 547; active, spas and modes of treatment in, 549; effect of carbonic acid and nitrogen, 550; expectoration increased by waters, 551; inhalations, 553; baths and douches, 554; use of cold, 555; enumeration of spas, 555; sool-baths in, 558; stationary, treatment of, 560; sulphur in, 561; tar, 562; exercise, 562; use of spirometer, 563; condensed air in, 563; cold-water treatment, 564; enumeration of places for treatment of diseases of casual relation to phthisis, 566; whey cures, 569; summer resorts, 569; elevated health-resort, effect of, 571; enumeration of, 578; officinal climatic resorts, 588; moist health-resorts of equable temperature, 593; drier health-resorts, 601; indifferent health-resorts, 610; table of health-resorts, 612

Physical effect of psychical influences, 21; activity, relation to mental development, 22; forces, compensation of, 41

Physician, choice of in phthisis, 546; at Spa, 614

Physiology, importance of in chronic diseases, 13

Pisa, a health-resort in phthisis, 595; temperature and rain, 612

Piscines, escape of gas from, 272; in Pyrenean sulphur-baths, 279; at Barèges, 283; at Mehadia, 293

Pityriasis versicolor, temporarily removed by sool-baths, 198

Plethora of abdomen. *See* Abdomen, plethora of

Pleuritic exudations, use of soda and common-salt-waters in, 336

PYR

Plombières, temperature and elevation of baths, 169, 170; warm springs at, 172; arsenic in water, 480

Pneumatic apparatus, alleged therapeutic results of, 49; use of in phthisis, 563

Pneumonia, in relation to phthisis, 523

Poisoning, chronic metallic, use of cold water in, 73, 109; sulphur-baths, 276; sulphur-waters, 417; summary of treatment of, 486

Ponte Seraglio, hot earthy baths at, 182

Pontresina, a health-resort, 586

Portal vein, use of sulphur-waters in stasis of, 416

Portishead, a sea-bathing place, 263

Portrush, a sea-bathing place, 263

Potash, carbonate of, effect of, 324

Potash, sulphate of, in sea-waters, 256

Potassium, iodide of, in tabes, 159

Potassium, sulphuret of, effect of inunction of, 271, 272

Preblau, carbonic acid in waters, 315; soda-springs of, 347; bicarbonate of iron in waters, 464

Preparation for bath-treatment, necessity of, 46

Priessnitz, use of his system, 5; immoderate internal use of water by, 63; his treatment of psoriasis, 114

Promenade at springs, 628

Prostatitis, chronic, cold hip-baths in, 119

Prurigo, treatment of, 115; use of sulphur in, 274

Psoriasis, treatment of, 114; effect of sool-baths, 198; use of sulphur in, 274

Psychical influence of travelling, 20; value of in hysteria, 111

Püllna, carbonic acid in waters, 316; analysis of bitter waters, 359; sulphate of lime, 427; carbonate of lime in, 428

Pulse, effect of temperature of blood on, 92; effect of cold bath on, 96; effect of iron on, 449

Purity of air, 32

Purpura, treatment of, 116

Purton spa, 360

Pustular eruptions, use of sulphur-baths in, 273

Putbus, a sea-bathing place, 265

Pyrenees, sulphur-baths of, 279

Pyrmont, chlorides in mother-lye of, 209; sool-baths at, 232; carbonic acid in waters, 316, 402; sulphates in waters, 356; chlorides in, 402; common-salt-waters of, 404; sulphate of lime in waters, 427; carbonate of

PYS

- lime, 428; iron in, 465; elevation of, 466; steel-spring at, 474; arsenic in waters, 480; waters useful in restoration of weak organism, 549
Pyatjan, sulphur-baths at, 294; moor-baths, 300; sulphate of lime in waters, 426

QUININE in tabes, 159

- RABKA*, sool-baths at, 217
 Rachitis, etiology of, 424
Radna, iron in water, 465
Ragatz, use of waters for removal of gouty exudations, 138; temperature and elevation, 169, 170; warm baths at, 174
 Rain in relation to atmospheric moisture, 540
Ramsgate, a sea-bathing place, 262
 Reaction after cold bath, 97; value and character of, 98
Recoaro, elevation of, 466; iron-springs of, 475
Redcar a sea-bathing place, 262
 Reflex paralysis, water-cure hurtful in, 118; treatment of, 153, 496
 Refrigeration by cold bath, 98
Rehburg, whey establishment at, 439, 440; a health-resort in phthisis, 570
Rehme, chlorides in sool of, 208; compared with Kreuznach, 221; gaseous thermal sool-baths of, 235, 248; carbonic acid in waters of, 316; sulphate of lime in waters, 427; iron in, 464; arsenic in waters, 480
Reichenhall, chlorides in mother-lye and sool, 209; sool-baths at, 226; sool-spray-baths, 249; sulphate of lime in waters, 427; whey establishment at, 439; inhalatorium at, 553; a health-resort in phthisis, 570
Reinerz, carbonic acid in waters, 316; carbonate of lime, 428; whey establishment at, 439; iron-waters, 465, 475; elevation, 466; arsenic in water, 480; a health-resort in phthisis, 579
 Respiration, effect of season on, 44; of barometric variations, 48; in condensed air, 51
 Respiratory membrane, catarrh of. See Catarrh of respiratory membrane
Reutlingen, sulphur-baths at, 290
 Rheumatic paralysis, treatment of, 496
 Rheumatism, treatment by cold water,

SAI

- 117; definition of, 139; acute, 140; fascial and muscular, 140; articular 140; of bowels, not admitted, 141; nervous, a vague term, 141; treatment by warm baths, 142, 176, 183; by vapour-baths, 185; by grotto of Monsummano, 188; by sand-baths, 190; by sool-baths, 199, 243; by sea-bathing, 260; by sulphur-baths, 274; by moor-baths, 295; by soda-waters, 344, 345; summary of treatment, 487
Rhyl, sea-bathing at, 263
Rigi Kaltbad, cold-water establishment at, 121; a health-resort, 586
Rigi Scheideck, a health-resort, 586
 River-bathing in weakness of skin, 111, 141
Riviera di Ponente, health-resorts of, 602
Riedquelle, recommended for drinking, 227
Rippoldsau, pine-leaf-baths at, 306; carbonic acid in water, 316; common salt in, 329; carbonate of lime in, 333, 428; iron waters, 465, 468; elevation of, 466; a health-resort in phthisis, 580
 Rohden, Dr. L., chronic pulmonary consumption, 498
Rohitsch, carbonic acid in waters, 316; common salt in, 329; carbonate of lime in, 333, 428; analysis of waters, 363; Glauber's salt waters of, 383; iron in, 464
Roisdorf, carbonic acid in waters, 316; common salt in, 329, 350; composition of waters, 353; use of waters in dyspepsia, 394; carbonate of lime in, 428; iron in, 464
Rome, snow at, 541; a health-resort, 595
Römerbad, temperature and elevation of baths, 169, 170; warm baths of, 179
Rosenheim, sool-bath at, 226; iron in water, 465, 475; elevation of, 466
Rostrevor, a sea-bathing place, 263
Rothenfelde, sool-bath at, 233
Rothsaj, sea-bathing at, 263; a health-resort, 599
Rottweil, sool-bath at, 229
Royat, soda-springs at, 355
Rügenwalde, a sea-bathing place, 265
Ruhla, pinewood-baths at, 306
 Russia, form of anaemia in, 57
 Russian vapour-baths, 187
Ryde, a sea-bathing place, 262

SAIDSCHÜTZ, analysis of bitter waters, 359; sulphate of lime in water of, 427

SAI

- Saint-Amand*, sulphur-baths at, 285; moor-baths at, 300
Saint-Bees, sea-bathing at, 263
Saint-Leonards-on-Sea, sea-bathing at, 262; a health-resort in phthisis, 600
Saint-Moritz, carbonic acid in waters of, 316; carbonate of lime in, 428; iron in, 465; elevation of, 466; iron-waters of, 473; a health-resort in phthisis, 585
Saint-Sauveur, sulphur-baths at, 282
Saint-Yorre, soda-waters of, 344
Salcombe, a health-resort, 598
 Saline air in sool-bath resorts, 234
 Saliva, increase of by water-drinking, 67
 Salt, common. *See* Sodium, chloride of
 Salt, Glauber's. *See* Glauber's salt
Saltburn-by-the-Sea, a sea-bathing place, 262
Salterton, a health-resort, 598
 Salts, absorption of, 79
Salzbrunn, carbonic acid in water, 316; use of waters in bronchial catarrh, 329; soda-waters of, 348; carbonate of lime in water, 428; whey establishment at, 439; iron in water, 464
Salzhausen, chlorides in springs, 210; sool-baths at, 231
Salzungen, chlorides in springs, 209; sool-baths at, 228, 559; pinewood baths at, 306
Sameden, a health-resort, 586
San Bernardino, a health-resort, 586
 Sand-baths, 189
Sandgate, a sea-bathing place, 262
Sandown, a sea-bathing place, 262
San Remo, a health-resort in phthisis, 606; temperature, 612
Santa Catarina, elevation of, 465; iron-waters of, 475
 Scabies, use of sulphur in, 274
Scarborough, a sea-bathing place, 262; bitter waters at, 362
Schandau, iron-waters of, 465, 476
 Scherer, his views on formation of gravel, 75, 325
Scheveningen, a sea-bathing place, 264
Schinznach, sulphuretted hydrogen and salt in springs, 268; sulphur-baths at, 287; analysis of waters, 420; sulphate of lime in waters, 427
Schlangenbad, use of waters in gout, 138; in tabes, 161; warm baths, 167, 177; temperature and elevation, 169, 170; whey establishment at, 439
Schlagintweit, R., influence of height on human organism, 54
Schleusingen, pinewood baths at, 306

SEL

- Schmalkalden*, use of waters in scrofula, 204; chloride of sodium in springs, 210, 402; sool-baths at, 214; pinewood baths at, 306; carbonic acid in waters, 316, 402; common-salt-waters of, 407; sulphate of lime in waters, 427; iron in waters, 464
Schönsicht, cold-water establishment at, 121
Schwalbach, carbonic acid in waters, 316; carbonate of lime, 428; iron-waters, 465, 476; elevation of, 466
Schwalheim, carbonic acid in waters, 316
 Sciatica, hydrotherapeutic treatment of, 119; treatment by warm baths, 166; by vapour-baths, 185; saccharine urine in, 339
 Sclerosis of brain, 156; of spinal cord, 161
 Scottish douche, 192
 Scrofula, treatment of by sool-baths, 201, 243; by courses of water, 203; by iodine, 205; by sea-baths, 259; by soda-waters, 324; by sulphate-waters, 369; by common-salt-waters, 400
 Sea-air. *See* Air, sea
 Sea-bathing in hypochondriasis, 110; in hysteria, 111; in weakness of skin, 111, 119, 142, 260; in hæmorrhoidal tabes, 160; effect not to be separated from influence of sea-air, 252; characters of, 256; amount of salt in, 256; time for sea-bathing, 257; warm, 258; failures in, 258; cases suited for, 258; weakness, 258; phthisis, 259; scrofula, 259; weakness of skin, 260; paralysis, 156, 260; rheumatism, 260; sea-bathing places in England, 261; in Scotland, 263; in Ireland, 263; near German, Belgian, Dutch, and French coasts, 264; Atlantic and Mediterranean, 265; Baltic, 265
 Sea-mud baths, 300
 Sea-voyages in phthisis, 566
 Seasons, influence of on human body, 43
 Seborrhœa, treatment of, 113
 Secretions, effect of water on, 64, 67; chloride of sodium in, 385
Sedlitz, analysis of bitter waters, 359; sulphate of lime in waters, 427; carbonate of lime, 428
 Seegen, Professor, his observations on effect of Carlsbad waters, 364
Seelisberg, a health-resort, 587
Secuis, a health-resort, 586
Selters, carbonic acid in water, 316; common salt in, 329, 350; analysis of waters, 353; use of waters in catarrh

SEN

- of stomach, 392; carbonate of lime in, 428; iron in, 464
- Sensibility, effect of cold bath on, 96
- Shanklin*, sea-bathing at, 262
- Shortness of breath in phthisis, 515
- Sicily, health-resorts in, 606
- Sidmouth*, a health-resort, 597
- Silloth*, sea-bathing at, 263
- Sils-Maria*, a health-resort, 586
- Silva Plana*, a health-resort, 586
- Simla*, a health-resort, 587
- Sirocco wind, 538
- Skin, influence of moisture of air on, 40; of season, 44; absorption of water by, 78; moisture of water a means of cleansing, 82; effect of cold bath on, 96; importance of in loss of heat, 98; effect of warm bath on, 123, 127; effect of carbonic acid on, 236; absorption of sulphuretted hydrogen by, 270; effect of carbonate of soda on, 302
- Skin, diseases of, treatment of, 112, 148, 488; effect of Leuk baths on, 173; sool-baths in, 198; sulphur-baths in, 273
- Skin, weakness of, from mercurial courses, hydrotherapeutic treatment of, 74; treatment of, 111, 488; warm baths in, 141, 176; sool-baths in, 197, 243; sea-baths in, 260
- Sky, clear, 530
- Sleep, afternoon, 28
- Sluggishness of stomach and bowels, carbonic acid in, 312
- Snow, conditions causing, 541
- Social relations, importance of in phthisis, 547
- Soda, carbonate of, discovery of, 2; effect of acids in stomach on, 29; in alkaline springs, 301; effect on skin, 302; waters containing, 320, 343; effect on blood, 321; compared with chloride of sodium, 323; action on stomach, 323; on uric acid, 325; use of in gout, 326; in catarrh, 328; effect on secretion of bile, 337. *See* Soda-waters
- Soda, sulphate, discovery of, 2; physiological effect of, 356; water containing, 359; soda-waters containing, 362; use of in corpulence, 365; in diabetes, 366; in liver diseases, 367; in hæmorrhoidal conditions, 368; in catarrh, 370; in gout and gravel, 370; in ulcer of stomach, 371; in scrofulous exudations, 371; enumeration of waters containing, 372
- Soda-waters, use of, in gravel, 76, 325; in scrofula, 324; in gout, 326; in in-

SOO

- creased vascosity, 327; in catarrhs, 328; in catarrh of respiratory membrane, 328, 345, 347, 348; in catarrh of bladder, 330, 346; in catarrh of uterus and vagina, 331; in catarrh of stomach, 331, 344, 352, 393; in catarrh of bowels, 335; in catarrh of cystic duct, 335; for absorption of exudations, 336; for increasing secretion of bile, 337; in diabetes, 338; in congestion of abdominal organs, 341, 343, 352; simple forms of, 343; muriatic, 350
- Soden* (Aschaffenburg), chlorides in water, 209, 402; sool-baths, 213; carbonic acid and chlorides in, 316, 402; common-salt-waters of, 410
- Soden* (Taunus), chlorides in water, 210, 334, 402; sool-baths, 213; carbonate of lime in water, 334; carbonic acid in, 334, 402; temperature of springs, 334, 403; common-salt-waters of, 405; a health-resort, 557
- Soden, use of waters in catarrh of stomach, 334, 393; in abdominal plethors, 397; in bronchial catarrh, 399, 521; iron in, 464
- Sodium, chloride of, amount in various waters, 204, 206, 256, 329; in sea-air, 255; effect compared with carbonate of soda, 323; physiological effect of, 385; therapeutic character of, 389. *See* Common-salt-waters and Sool-baths
- Sodium, sulphuret of in baths, 268
- Softening of brain, 156; of spinal cord, 161
- Sonnenberg*, a health-resort, 587
- Solano wind, 538
- Sool-baths, 194; general characters of, 194; use of in chronic skin-diseases, 112, 198; in weakness of skin, 197; in rheumatism, 143, 199; in gout, 200; in neuroses, 201; in scrofula, 201; in anæmic conditions, 206; in non-scrofulous exudations, 206; choice of, 207; graduation of, 207; weak, without means of concentrating, 211; stronger or weaker, with means of concentration, 218; saline air produced in buildings, 234
- Sool-baths, gaseous thermal, of Rehme and Naulheim, 235; physical and chemical properties of, 237; effect of, 237; mode of treatment by, 239; use of in hypochondriasis, 110; in hysteria, 111; in retarded convalescence and other conditions of weakness, 134, 241; in weakness of skin, 111, 141, 243; in rheumatism, 143, 243;

800

in paralysis, 118, 150, 151, 157, 163, 164, 165, 246; in tabes, 160, 245; in exudative spinal meningitis, 161, 246; in scrofula, 202, 221, 243; in anæmia, 242; in plethora of abdomen, 242; in gout, 242; in diseases of bones, 244; in various neuroses, 247; in diseases of women, 247; in chronic skin diseases, 248. *See* Nauheim and Rehme

Sool-spray-baths, 186; at Rehme, 249

Sool-steam-baths, 186

Sophienbad, cold-water establishment at, 121

Soulszennatt, soda-water at, 349

Southend, sea-bathing at, 262

Spa, carbonic acid in waters of, 316; lime-salts in waters, 428; iron-waters of, 465, 476; elevation of, 466

Spa-treatment of active phthisis, 549; of stationary phthisis, 560

Spa, physician at the, 614

Spezzia, a health-resort in phthisis, 606

Spierkerroog, sea-bathing at, 264

Spinal cord, paralysis from exhaustion after illness, 150, 495; paralysis from concussion, 152, 496; paralysis from disorder of in children, 156, 247, 496; weakness of, 159; softening of, 161

Spinal irritation, sool-baths in, 247; sea-bathing in, 260; moor-baths in, 295; iron in, 461; summary of treatment, of 494

Spinal meningitis, exudative, cold-water treatment in, 118; warm baths in, 161; sool-baths in, 118, 246; summary of treatment of, 496

Spine, arthritis deformans of, 163

Spleen, enlargement of, use of moor-baths in, 290; Vichy waters in, 344; Carlsbad water in, 374; common-salt-waters in, 398; summary of treatment of, 490

Sputa in phthisis, 510

Stachelberg, sulphur-baths at, 290

Stechen, carbonic acid in waters, 316

Steel-baths, 134, 305

Steel-waters, carbonic acid in, 316. *See* Iron

Sternberg, iron-waters, 465, 477; arsenic in water, 480

Stiebel on course of rachitis, 424

Stimulation by cold bath, 98

Stomach, absorption of water by, 67; effect of water on, 68; effect of carbonic acid on, 310, 350; use of carbonic acid in atony of, 312; effect of carbonate of soda on, 323; soda-waters in disorders of, 331, 334, 352, 393; action of soda-water on, 350;

SWI

Glauber's salt-waters in catarrh of, 370, 373; chronic ulcers of, 371, 395, 492; effect of chloride of sodium on, 387; common-salt-waters in catarrh of, 392; summary of treatment of disorders of, 491

Strathpeffer, sulphur-springs at, 291

Streatham well, bitter-water, 360

Stresa, a health-resort in phthisis, 610

Streitberg, whey establishment at, 439, 440; a health-resort, 580

Stubnyya, carbonic acid in waters, 316; analysis of waters, 363; Glauber's salt-waters of, 383

Sudbrook Park, cold-water establishment, 122

Sudrøde, sool-baths at, 231

Sugar in wine, 339

Sugar of milk, therapeutic value of, 434

Sulphate of lime. *See* Lime, sulphate of

Sulphate of magnesia. *See* Magnesia, sulphate of

Sulphate of soda. *See* Soda, sulphate of

Sulphates in sea-waters, 256

Sulphur, use of in phthisis, 561

Sulphur-baths, 266; theory of use of, 266; small amount of sulphuretted hydrogen, 267, 268, 270; indications for, 273; skin diseases, 273; rheumatism, gout, and exulations, 139, 143, 274; paralysis and other neuroses, 154, 275; syphilis, 147, 276; chronic metallic poisoning, 276; enumeration of, in Pyrenees, 279; German, 285; Eugeanean, 292; Hungarian, 292

Sulphur-waters, contain little or no carbonic acid, 316; internal use of, 413; in bronchial catarrh, 415; in portal stasis, 160, 416; in metallic poisoning, 417; chemical constitution of, 418; analysis of, 420

Sulphuret of potassium, effect of inunction of, 271, 272

Sulphuret of sodium in baths, 268

Sulphuretted hydrogen, small amount of in sulphur-springs, 267, 268; poisonous effect of, 269; conclusions regarding, 272, 414; effects of, not observed in use of sulphur-waters, 413

Sulza, sool-baths at, 232; pine-leaf baths at, 306

Sulzbrunn, sool-baths at, 216

Summer, influence of on animal functions, 44; resorts in phthisis, 569

Snappers, late, 28

Swanage, a sea-bathing place, 262

Swizermühle, cold-water establishment at, 121

Swinemünde, a sea-bathing place, 265

SYC

- Sycosis, not cured by sool-baths, 198
 Symptomatic diabetes, 339
 Syphilis, hydrotherapeutic treatment of, 74; warm baths in, 147; sulphur-baths in, 276; summary of treatment of, 485
Szczawnica, soda-waters of, 354

TABES DORSALIS, water-cure forbidden in, 118; causes of, 157; treatment of, 158, 497; warm-baths in, 159; sool-baths in, 245; sea-bathing in, 260

Tabes secundaria, 163

Tanquerel des Planches, his observations on effect of sulphur in lead-poisoning, 276

Tar, use of in pemphigus, 116; phthisis, 562

Tarasap, use of waters of in hæmorrhoidal conditions, 76; in gout, 139, 370; sulphates in waters, 356; analysis of waters, 363; use of in diabetes, 366; in scrofulous exudations, 371; sulphated waters of, 377; in catarrh of stomach, 394; carbonate of lime in waters, 428; iron in, 464

Teignmouth, sea-bathing at, 263

Teinach, alkaline water at, 346; a health-resort in phthisis, 570

Temperature, effect of different, 43; of water, 68, 84; of cold bath, 101; of warm baths, 129; of indifferent thermal springs, 167; table of, 169, 170; of soda-springs, 329; of sea-water, 256; of atmosphere in relation to phthisis, 533; daily variations of, 617; of mineral waters, how regulated, 621

Tenby, a sea-bathing place, 263

Teplitz, use of baths in gout, 138, 200; in articular rheumatism, 143; in *tabes secundaria*, 163; in sciatica, 166; temperature and elevation, 169, 170; warm baths of, 171; use of in diseases of bones, 245; in metallic poisoning, 278; moor-baths at, 300

Teplitz-Treusien, sulphuretted hydrogen and salts in water, 268; sulphur-baths at, 294; moor-baths at, 300; sulphate of lime in waters, 426; carbonate of lime in, 428

Testicles, enlargement of, treated by sool-baths, 207

Tewit spring at Harrogate, 471

Tharand, cold-water establishment at, 121; pine-leaf baths at, 306

Thermal baths. *See* Sool-Baths, Gaseous thermal; and Warm Baths

Thorax, paralytic, 502

UTE

Tic douloureux, treatment of, 169

Tissue, change of, influence of modern views of on balneotherapy, 5; effect of water on, 66; effect of sool-baths on, 195

Tissues, water in, 63; chloride of sodium in, 385

Tobellad, thermal baths at, 170

Tönnisstein, alkaline spring at, 355

Tonsils, treatment of hypertrophy of, 146

Töplitz Warasdin, sulphuretted hydrogen in waters, 268; sulphur-baths, 294; analysis of waters, 420; sulphate of lime in, 426

Torpid phthisis, 513, 589

Torquay, sea-bathing at, 262; a health-resort, 597; temperature and rain, 612

Tramore, sea-bathing at, 263

Traumatic exudations, warm baths for, 145; paralyzes, treatment of, 497

Traunstein, sool-bath at, 225

Travelling as a therapeutic agent, 18; in hypochondriasis, 110; in hysteria, 111

Travemünde, a sea-bathing place, 265

Trouville, a sea-bathing place, 265

Tubercles of lungs, *Tarasap* springs in, 378; common-salt-waters in, 398

Tuberculosis, miliary, distinction from chronic phthisis, 505

Tüffer, use of waters in gout, 139; temperature and elevation, 169, 170; warm baths at, 180

Tumours, treatment of, 493

Tunbridge Wells, iron-springs at, 465, 477; elevation of, 466

Turkish baths, 185, 187

Tyndall and Frankland's experiments on combustion in rarefied air, 59

Tynemouth, a sea-bathing-place, 262

Typhoid paralysis, treatment by warm baths, 164, 496

ULCERS of feet and legs, treatment of, 174, 198; of stomach. *See* Stomach

Undercliff, a health-resort in phthisis, 600

Urea, increase of by water-drinking, 66

Uriage, sulphur-spring at, 285

Uric acid concretions, treatment by Carlsbad waters, 374. *See also* Gravel

Urine, effect of season on, 44; of water, 66; sugar in, 338, 339

Urticaria, treatment of, 113

Uterus, chronic inflammation of, treatment of, 145; sool-baths in diseases of, 247; soda-waters in catarrh of, 331; common-salt-waters in diseases

VAG

of, 401; Vichy waters in infarction of, 344; use of iron in bleeding from, 459

VAGINA, soda-waters in catarrh of, 331

Fals, alkaline waters of, 349

Vapour-baths in peripheric paralyses, 154; effects and indications of, 184

Vegetation, effect of on country air, 37

Venice, atmospheric moisture at, 540; snow at, 541; a health-resort, 595; temperature and rain, 612

Venosity, increased, 327

Ventnor, a health-resort, 600; temperature and rain, 612

Vernet, sulphur-baths at, 284

Vertebral column, arthritis deformans of, 163

Vichy, waters of in gout, 76, 137, 139; carbonic acid in waters, 315; use of waters in gravel, 326; common salt in water, 329; temperature of, 329; use in catarrh of respiratory membrane, 329; in catarrh of bladder, 330, 370; in catarrh of stomach, 335, 394; in diabetes, 340, 366; alkaline waters of, 343; carbonate of lime in waters, 428; iron in, 464; arsenic in, 480

Vichy, carbonic acid in waters, 316; iron-springs of, 465

Victoria spa, bitter water, 360

Vivenot's conclusion regarding condensed air in phthisis, 49

Villa d'Este, a health-resort, 610

Villa Serbelloni, a health-resort, 610

Vitznau, a health-resort, 610

Vomiting produced by chloride of sodium, 387

WANGEROOG, a sea-bathing place, 264

Warm baths, 123; elementary effect of, contrasted with effect of cold bath, 123; fundamental character of effect, 125; Karner's classification of degrees of temperature of, 129; indifferent, 129; warm, 130; very warm, 130; hot, 130; indications for warm baths, 131; general weakness and difficult convalescence, 132; anaemia, 136; diseases of nutrition, 136; gout, 136; rheumatic diseases, 139; weakness of skin, 141; muscular rheumatism, 142; corpulence with rheumatism, 143; chronic articular rheumatism, 143; serofulous exudations, 144; traumatic exudations, 145; ovarian tumours, 145; chronic

WEA

metritis, 145; dropsy, 146; tumours of breast, 146; chronic orchitis, 146; syphilis, 147; disturbance of abdominal functions, 147; chronic exanthemata, 148; paralysis, 148; hyperaesthesia and convulsive forms of disease, 165; indifferent thermal baths, 166; differences of temperature, 167; table according to temperature, 169; according to elevation, 170; description of various, 170

Warmbrunn, use of waters for absorption of gouty exudations, 138; in tabs, 161; temperature and elevation of, 169, 170; warm baths at, 179

Warmth, regulation of, 12; influence on health of man, 43

Warnemünde, sea-bathing at, 265

Water, increased use of, 63; general experience regarding, 63; in the blood, tissues, and secretions, 64; lixivation by, 65; use in inanition, 65; influence on change of substance, 66; summary of functions of, 66; may replace physical exercise, 67; effect of water-drinking on diuresis and perspiration, 67; on secretion of bile, 67; absorption of, 67; effect on stomach, 68; temperature of drinking-water, 68; chemical constituents, 70; *résumé* of effects, 71; indications for water-drinking, 72; in chronic metallic poisoning, 73; in syphilis, 74; in atony of the skin, 74; in gout, 74; in gravel, 75; in haemorrhoidal conditions, 76; outward application of, 76; absorption through skin, 78; moisture of, a means of cleansing the skin, 82; weight of, 83; temperature of, in relation to heat of body, 84. *See also* Cold Baths and Warm Baths

Waters, medicinal, drinking courses of, 307; carbonic acid in, 310; nitrogen in, 317; carbonate of soda in, 320; sulphates of soda and magnesia in, 356; common-salt, 384; sulphur, 413; earthy mineral, 422; iron, 444; mineral component parts of, 478; period for courses of, 620; time for drinking, 620; temperature, 621; combination of with baths, 627; promenade with, 628; diet during course, 628; duration of course, 629; artificial, 631

Wave-baths, use of in skin-weakness, 111; at Kissingen, 229, 230

Weakness, general, treatment by warm baths, 132; by cool-baths, 241; by sea-bathing, 268; summary of treatment of, 483

WEI

Weight of body, how affected by bathing, 79; of water, 83

Weilbach, use of waters in hæmorrhoidal tabes, 160; sulphuretted hydrogen and salts in waters, 268; sulphur-baths at, 288, 290; use of waters in liver diseases, 368, 414; analysis of waters, 420; carbonate of lime in, 428; a health-resort, 567

Weissbad, whey establishment at, 440; a health-resort, 587

Weissenburg, carbonic acid in waters, 316; use of waters in atony of stomach, 333; carbonate of lime in waters, 333, 428; sulphate of lime in waters, 427; earthy mineral waters, 431; a health-resort in phthisis, 557

Well-fever, 69

West Indian islands, not suited for active phthisis, 594

Westerland auf Sylt, a sea-bathing place, 264

Weston-super-Mare, a sea-bathing place, 263

Weymouth, a sea-bathing place, 262

Whey, constitution of, 433; action of, 434

Whey-cure, 433; explanation of value of, 436; establishments for, 439

Whitby, sea-bathing at, 262

Wiesbaden, cold-water establishments at, 120; use of waters for absorption of gouty exudations, 138, 200; in chronic articular rheumatism, 143, 200; in tabes secundaria, 163; in sciatica, 166; temperature and elevation of, 169, 170; chlorides in waters, 204, 209, 334, 402; sool-baths at, 214; use of in diseases of bones, 245; carbonic acid in waters, 316, 334, 402; use of waters in catarrh of stomach, 334; temperature of waters, 335; compared with Kissingen, 390; temperature of waters, 402; common-

ZOP

salt-waters of, 411; iron in, 464; arsenic in water, 480; a health-resort in phthisis, 611

Wiesau, iron-waters at, 477

Wight, Isle of, sea-bathing places in, 262; health-resorts in, 600

Wildbad, use of waters for absorption of gouty exudations, 138; use of in tabes, 160, 161; temperature and elevation of, 169, 170; warm baths at, 177

Wildbäder or natural baths, 168, 280, 282

Wildegge, chlorides in waters, 210, 402; sool-bath at, 216; carbonic acid in, 402; common-salt-waters of, 410; sulphate of lime in waters, 427

Wildungen, carbonic acid in waters, 316; use of waters in vesical diseases, 330, 429; in catarrh of stomach, 333; carbonate of lime in waters, 333, 427; earthy mineral waters of, 429

Wind, 536

Wine, use of in phthisis, 545

Winter, effect of on functions of body, 43

Wittekind, chlorides in bath-salt of, 209; sool-baths at, 233

Women, paralytic weakness in, after loss of blood, 150; after tedious labour, 150; thermal sool-baths in diseases of, 247

Woodhall, waters of, 217

Worthing, a sea-bathing place, 262

Wyk auf Föhr, a sea-bathing place, 264

YARMOUTH, sea-bathing at, 262

ZAIZON, carbonic acid in waters of, 316
Zoppot, a sea-bathing place, 265

NEW AND RECENT WORKS

PUBLISHED BY

SMITH, ELDER, & CO.

A PRACTICAL TREATISE ON DISEASES OF THE LUNGS;

Including the Principles of Physical Diagnosis, and Notes on Climate. By WALTER HAYLE WALSH, M.D. Fourth Edition, revised and much enlarged. Demy 8vo. 16s.

A PRACTICAL TREATISE ON THE DISEASES OF THE HEART AND GREAT VESSELS;

Including the Principles of their Physical Diagnosis. By WALTER HAYLE WALSH, M.D. Fourth Edition, thoroughly revised and greatly enlarged. Demy 8vo. 16s.

THE PATHOLOGICAL ANATOMY OF THE NERVOUS CENTRES.

By EDWARD LONG FOX, M.D., F.R.C.P., Physician to the Bristol Royal Infirmary late Lecturer on the Principles and Practice of Medicine and on Pathological Anatomy at the Bristol Medical School. With Illustrations, demy 8vo. 12s. 6d.
[Just published.]

THE MAINTENANCE OF HEALTH.

A Medical Work for Lay Readers. By J. MILNER FOTHERGILL, M.D., M.R.C.P., Junior Physician to the West London Hospital. Crown 8vo. 12s. 6d.
[Just published.]

A PRACTICAL AND THEORETICAL TREATISE ON DISEASES OF THE SKIN.

By GEORGE NAYLOR, F.R.C.S. Second Edition, with Illustrations. 8vo. 12s. 6d.
[Just published.]

ON FUNCTIONAL DERANGEMENTS OF THE LIVER.

By C. MURCHISON, M.D., LL.D., F.R.S., Physician and Lecturer on Medicine, St. Thomas's Hospital, and formerly on the Medical Staff of H.M. Bengal Army. Crown 8vo. 5s.
[Just published.]

THE ESSENTIALS OF BANDAGING;

Including the Management of Fractures and Dislocations, with Directions for Using other Surgical Apparatus. With 122 Engravings. By BERKELEY HILL, M.B. Lond., F.R.C.S. Second Edition, revised and enlarged. Fep. 8vo. 3s. 6d.

London: SMITH, ELDER, & CO., 15 Waterloo Place.

NEW AND RECENT WORKS

PUBLISHED BY

SMITH, ELDER, & CO.

AN EPITOME OF THERAPEUTICS.

Being a Comprehensive Summary of the Treatment of Disease as recommended by the leading British, American, and Continental Physicians. By W. DOMMETT STONE, M.D., F.R.C.S. Crown 8vo. 8s. 6d.

AN INTRODUCTION TO THE STUDY OF CLINICAL MEDICINE.

Being a Guide to the Investigation of Disease, for the Use of Students. By OCTAVIUS STURGES, M.D. Cantab., F.R.C.P., Assistant Physician to Westminster Hospital. Crown 8vo. 4s. 6d.

THE ANATOMY OF THE LYMPHATIC SYSTEM.

By E. KLEIN, M.D., Assistant Professor of the Laboratory of the Brown Institution, London. With 10 double-page Illustrations, 8vo. 10s. 6d.

These Researches are published with the sanction and approval of the Medical Officer of the Privy Council. The Government Grant Committee of the Royal Society have furnished means for the execution of the plates.

ON THE CONVOLUTIONS OF THE HUMAN BRAIN.

By Dr. ALEXANDER ECKER, Professor of Anatomy and Comparative Anatomy in the University of Freiburg, Baden. Translated, by permission of the Author, by JOHN C. GALTON, M.A. Oxon., M.R.C.S., F.L.S., Clinical Assistant in the West Riding Asylum. Post 8vo. 4s. 6d.

LECTURES ON BRIGHT'S DISEASE.

With Especial Reference to Pathology, Diagnosis, and Treatment. By GEORGE JOHNSON, M.D., F.R.S., Fellow of the Royal College of Physicians, Physician to King's College Hospital, Professor of Medicine, King's College, &c. With numerous Illustrations. Post 8vo. 5s.

A TREATISE ON THE PNEUMATIC ASPIRATION OF MORBID FLUIDS.

A Medico-Chirurgical Method of Diagnosis and Treatment of Cysts and Abscesses of the Liver, Strangulated Hernia, Retention of Urine, Pericarditis, Pleurisy, Hydrarthrosis, &c. By Dr. GEORGES DIEULAFOY, Gold Medallist of the Hospitals of Paris. Post 8vo. 12s. 6d.

London : SMITH, ELDER, & CO., 15 Waterloo Place.

